Fig.1

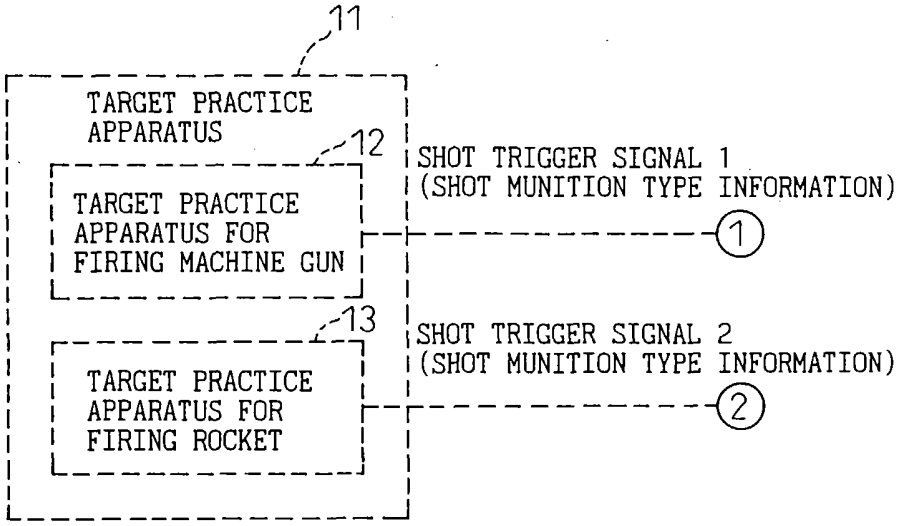

11
TARGET PRACTICE APPARATUS
12
TARGET PRACTICE APPARATUS FOR FIRING MACHINE GUN
13
TARGET PRACTICE APPARATUS FOR FIRING ROCKET
SHOT TRIGGER SIGNAL 1
(SHOT MUNITION TYPE INFORMATION)
①
SHOT TRIGGER SIGNAL 2
(SHOT MUNITION TYPE INFORMATION)
②

Fig. 2

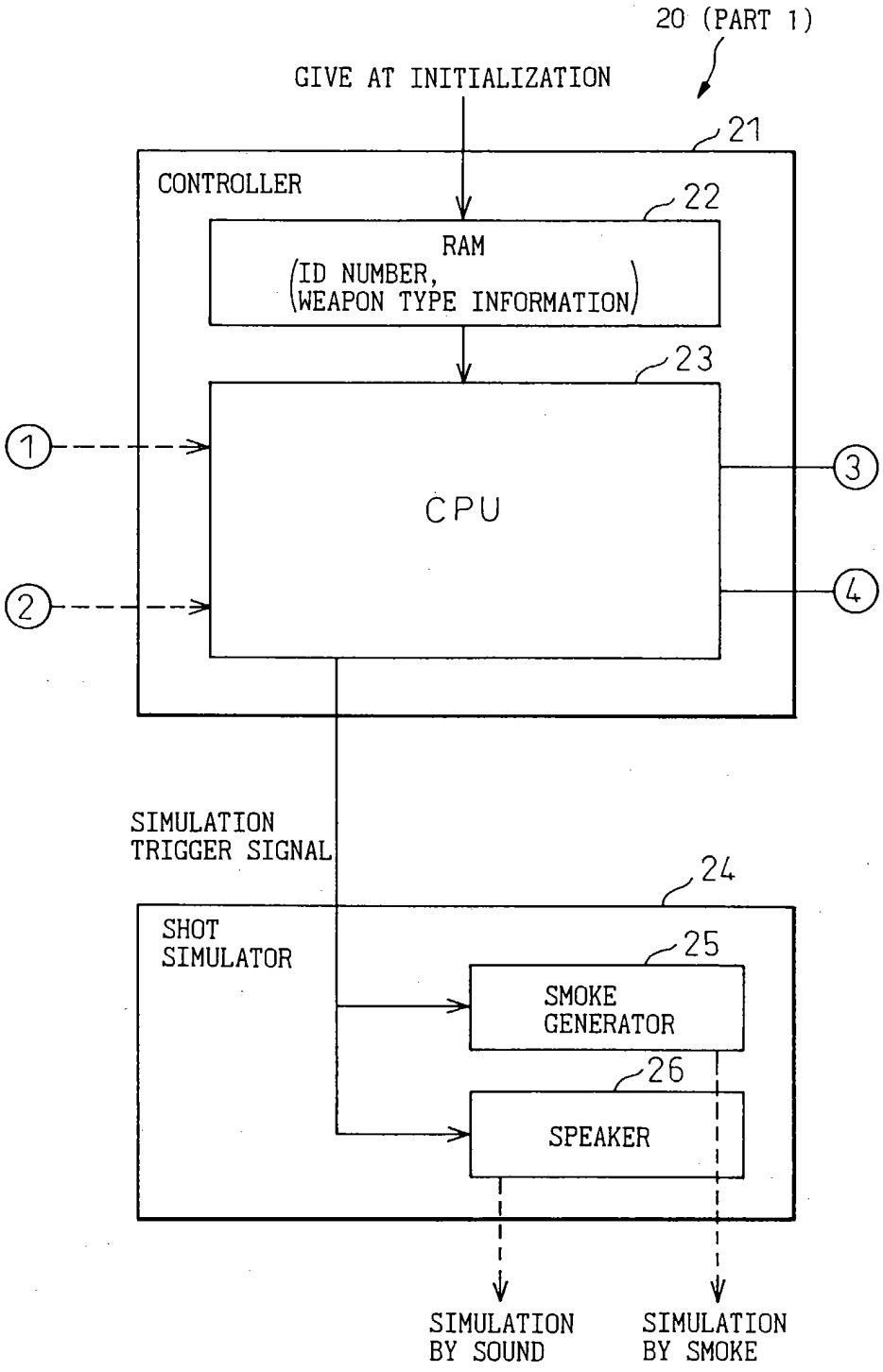

20 (PART 1)
GIVE AT INITIALIZATION
21
CONTROLLER
22
RAM
(ID NUMBER,
WEAPON TYPE INFORMATION)
23
CPU
1
2
3
4
SIMULATION
TRIGGER SIGNAL
24
SHOT
SIMULATOR
25
SMOKE
GENERATOR
26
SPEAKER
SIMULATION
BY SOUND
SIMULATION
BY SMOKE

Fig.3

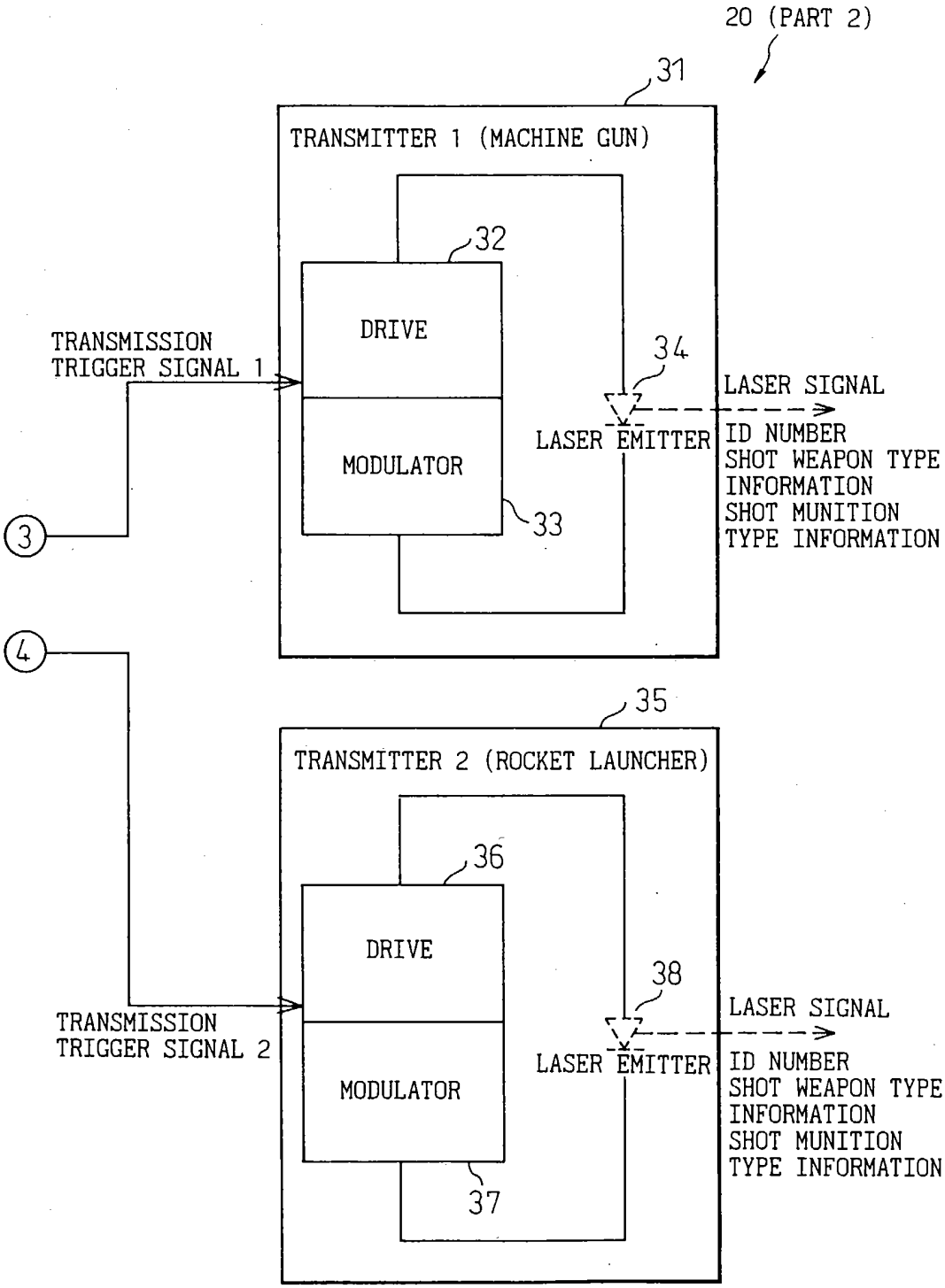

20 (PART 2)
31
TRANSMITTER 1 (MACHINE GUN)
32
DRIVE
34
TRANSMISSION
TRIGGER SIGNAL 1
LASER SIGNAL
LASER EMITTER
ID NUMBER
SHOT WEAPON TYPE
INFORMATION
SHOT MUNITION
TYPE INFORMATION
MODULATOR
33
3
4
35
TRANSMITTER 2 (ROCKET LAUNCHER)
36
DRIVE
38
TRANSMISSION
TRIGGER SIGNAL 2
LASER SIGNAL
LASER EMITTER
ID NUMBER
SHOT WEAPON TYPE
INFORMATION
SHOT MUNITION
TYPE INFORMATION
MODULATOR
37

Fig. 4

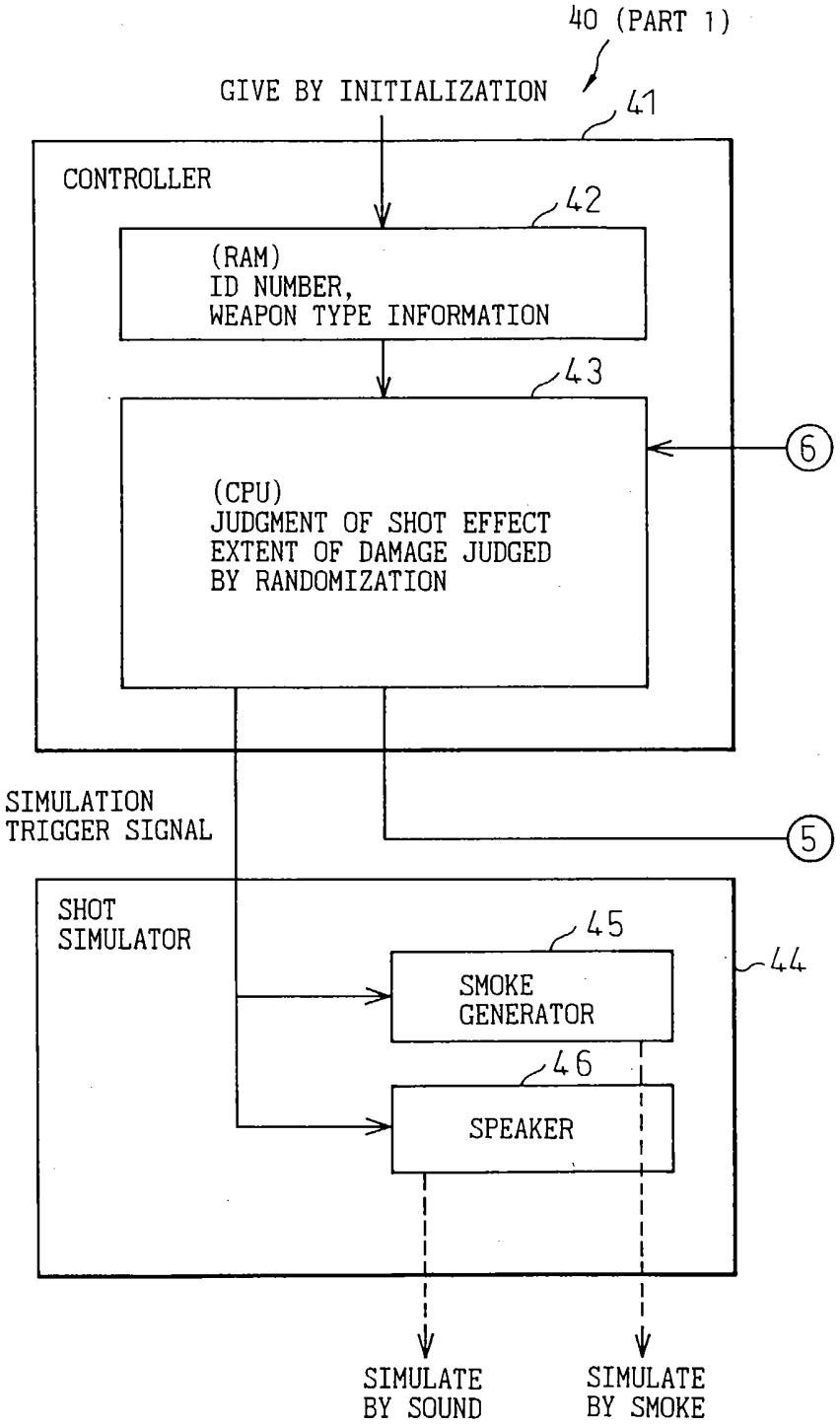

40 (PART 1)
GIVE BY INITIALIZATION
41
CONTROLLER
42
(RAM)
ID NUMBER,
WEAPON TYPE INFORMATION
43
(CPU)
JUDGMENT OF SHOT EFFECT
EXTENT OF DAMAGE JUDGED
BY RANDOMIZATION
6
SIMULATION
TRIGGER SIGNAL
5
SHOT
SIMULATOR
45
SMOKE
GENERATOR
44
46
SPEAKER
SIMULATE
BY SOUND
SIMULATE
BY SMOKE

Fig.5

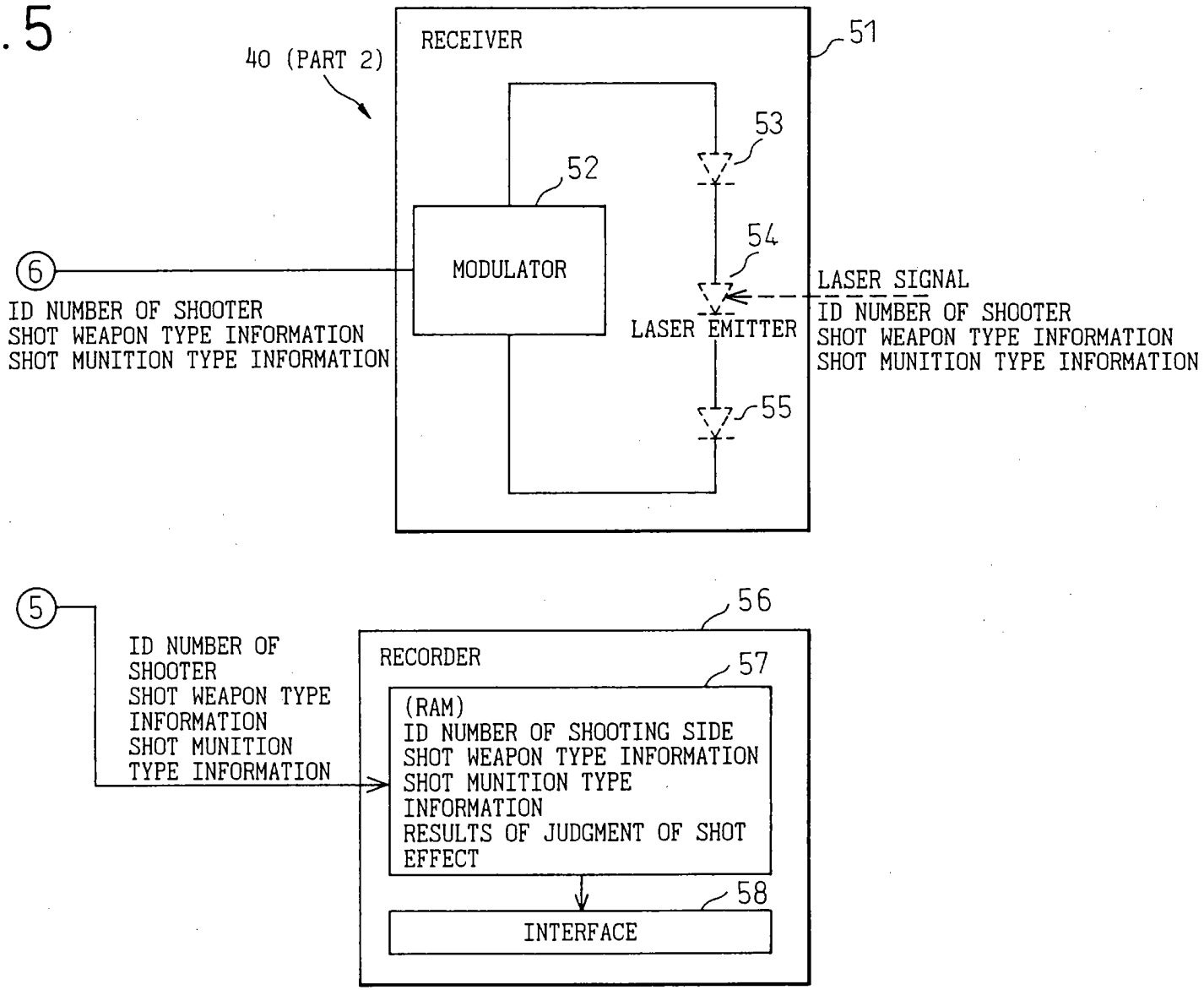

40 (PART 2)
RECEIVER
51
53
52
54
MODULATOR
6
ID NUMBER OF SHOOTER
SHOT WEAPON TYPE INFORMATION
SHOT MUNITION TYPE INFORMATION
LASER SIGNAL
ID NUMBER OF SHOOTER
SHOT WEAPON TYPE INFORMATION
SHOT MUNITION TYPE INFORMATION
LASER EMITTER
55
5
ID NUMBER OF SHOOTER
SHOT WEAPON TYPE INFORMATION
SHOT MUNITION TYPE INFORMATION
56
RECORDER
57
(RAM)
ID NUMBER OF SHOOTING SIDE
SHOT WEAPON TYPE INFORMATION
SHOT MUNITION TYPE INFORMATION
RESULTS OF JUDGMENT OF SHOT EFFECT
58
INTERFACE

Fig.6

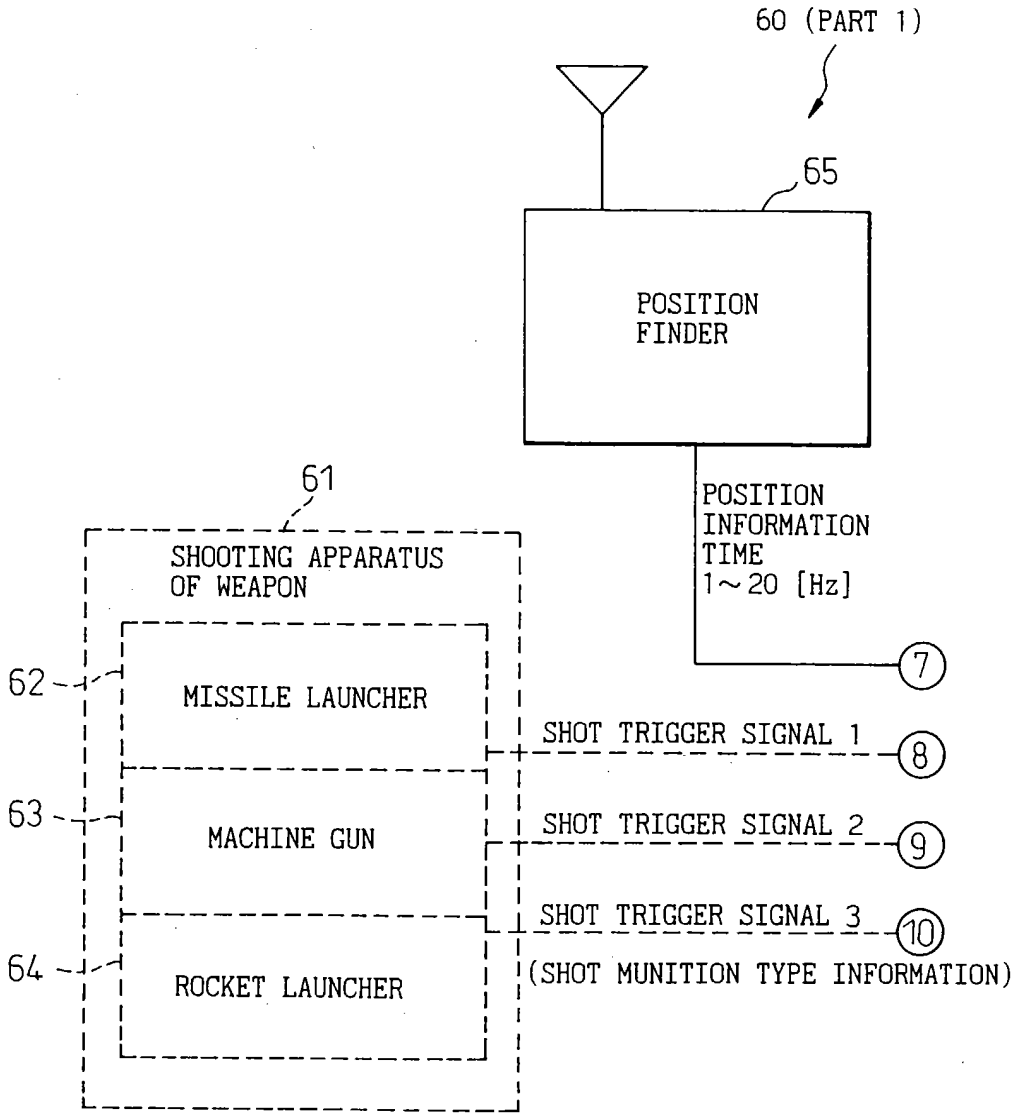

60 (PART 1)
65
POSITION FINDER
61
SHOOTING APPARATUS OF WEAPON
POSITION INFORMATION TIME 1～20 [Hz]
7
62
MISSILE LAUNCHER
SHOT TRIGGER SIGNAL 1
8
63
MACHINE GUN
SHOT TRIGGER SIGNAL 2
9
SHOT TRIGGER SIGNAL 3
10
64
ROCKET LAUNCHER
(SHOT MUNITION TYPE INFORMATION)

Fig.7

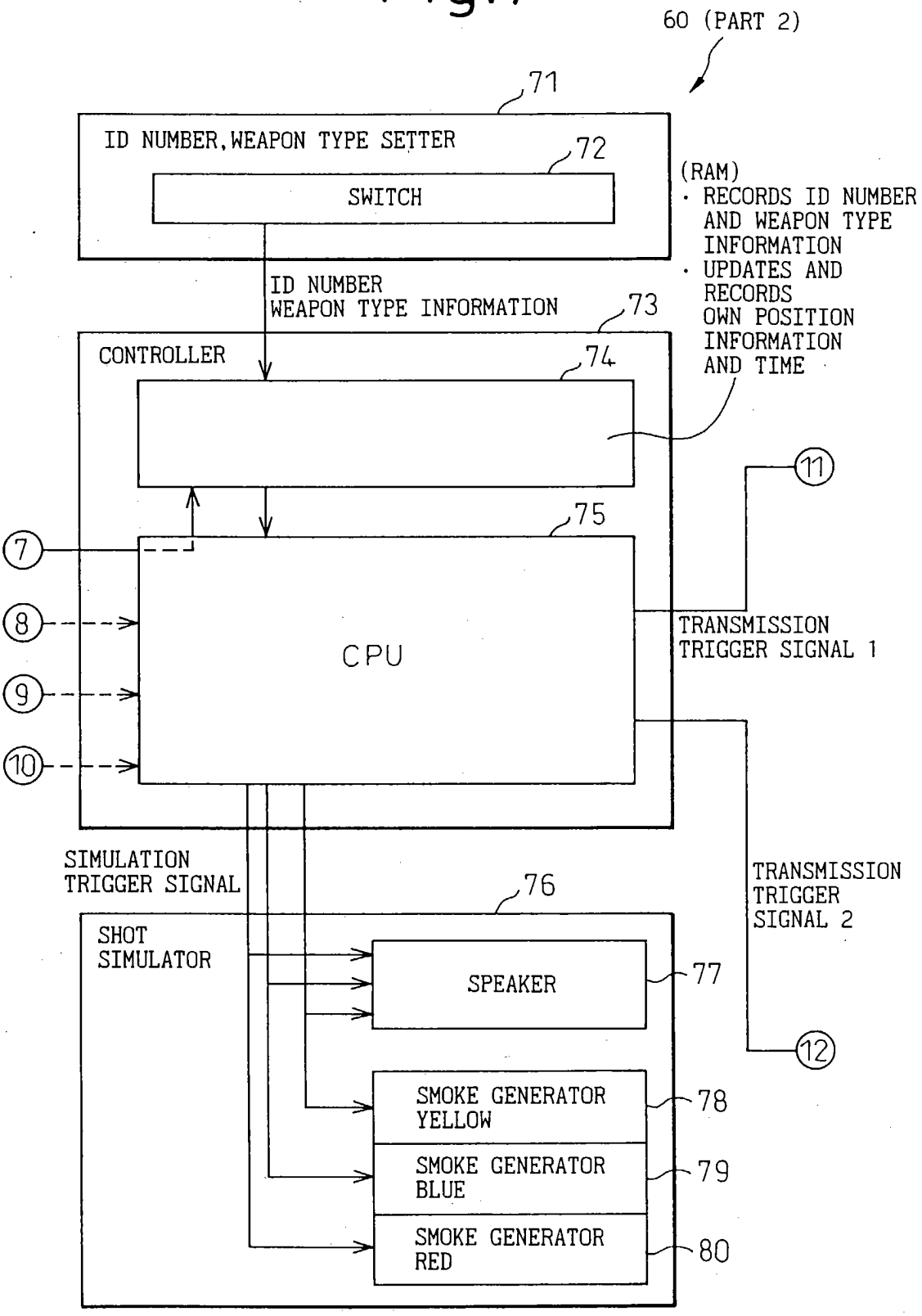

60 (PART 2)
71
ID NUMBER, WEAPON TYPE SETTER
72
SWITCH
(RAM)
· RECORDS ID NUMBER AND WEAPON TYPE INFORMATION
· UPDATES AND RECORDS OWN POSITION INFORMATION AND TIME
ID NUMBER
WEAPON TYPE INFORMATION
73
CONTROLLER
74
75
CPU
7
8
9
10
11
12
TRANSMISSION TRIGGER SIGNAL 1
TRANSMISSION TRIGGER SIGNAL 2
SIMULATION TRIGGER SIGNAL
76
SHOT SIMULATOR
SPEAKER
77
SMOKE GENERATOR YELLOW
78
SMOKE GENERATOR BLUE
79
SMOKE GENERATOR RED
80

Fig.8

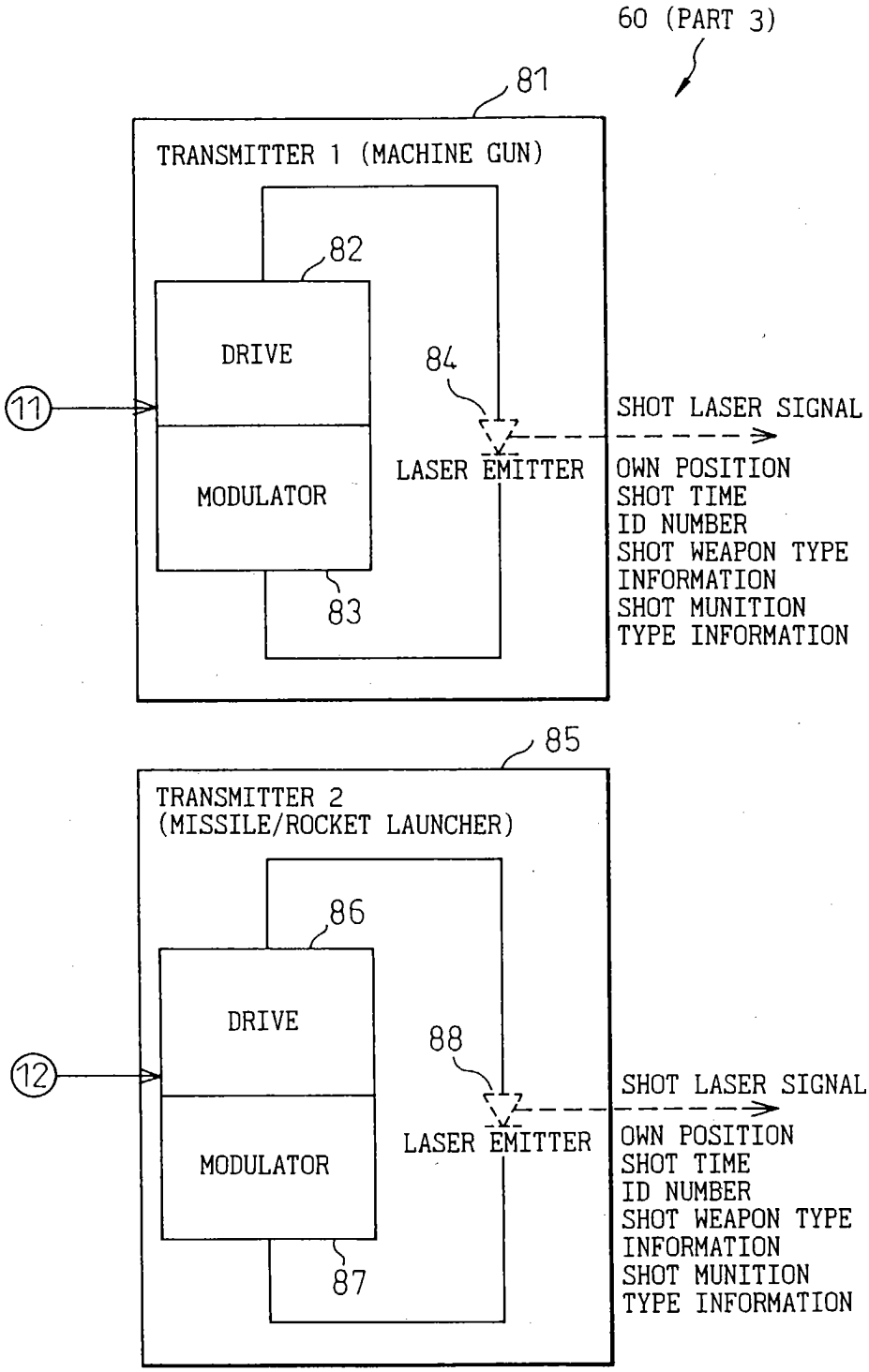

60 (PART 3)
81
TRANSMITTER 1 (MACHINE GUN)
82
DRIVE
84
11
SHOT LASER SIGNAL
MODULATOR
LASER EMITTER
OWN POSITION
SHOT TIME
ID NUMBER
SHOT WEAPON TYPE
INFORMATION
SHOT MUNITION
TYPE INFORMATION
83
85
TRANSMITTER 2
(MISSILE/ROCKET LAUNCHER)
86
DRIVE
88
12
SHOT LASER SIGNAL
MODULATOR
LASER EMITTER
OWN POSITION
SHOT TIME
ID NUMBER
SHOT WEAPON TYPE
INFORMATION
SHOT MUNITION
TYPE INFORMATION
87

Fig.9

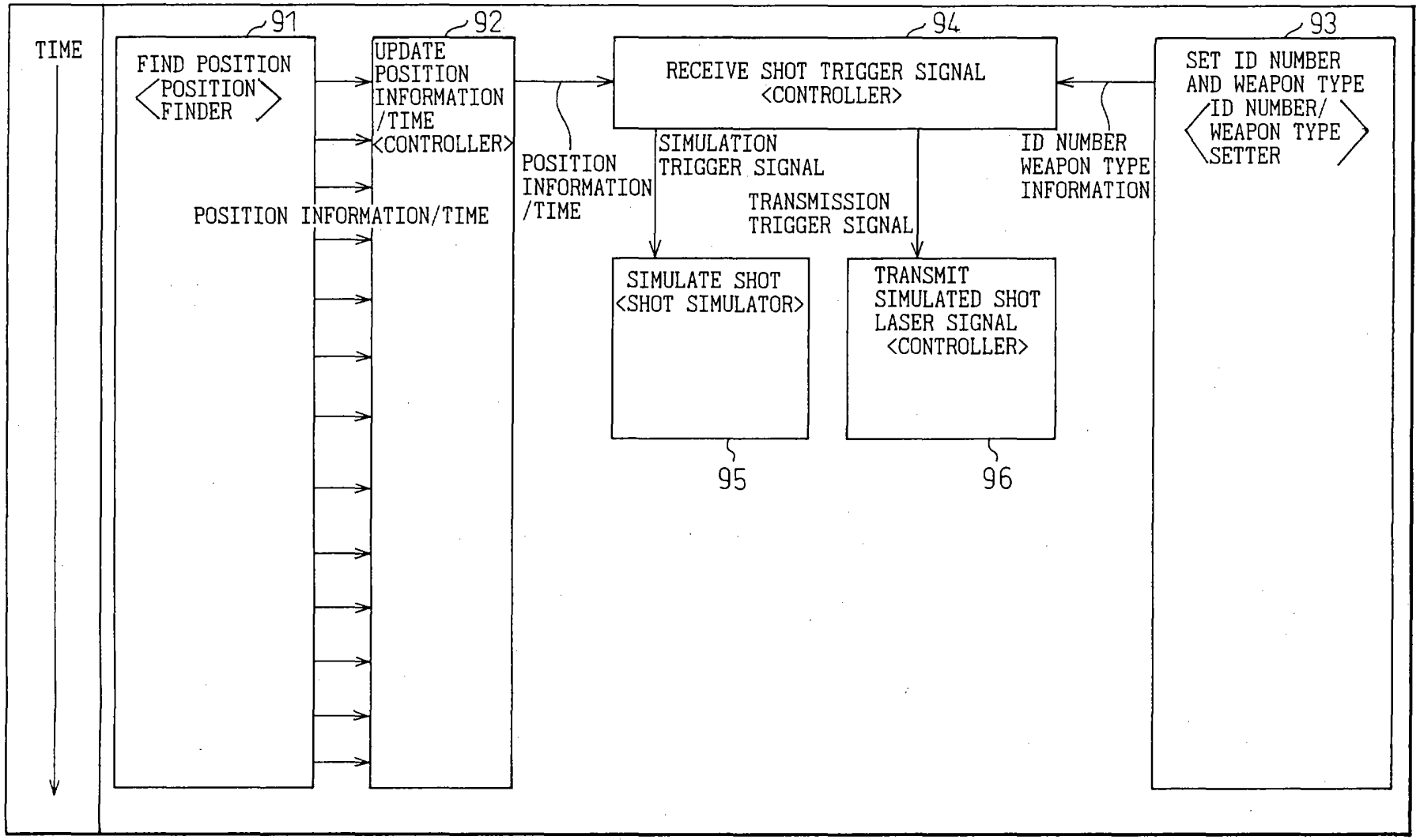

TIME
91
FIND POSITION
<POSITION FINDER>
92
UPDATE POSITION INFORMATION /TIME
<CONTROLLER>
POSITION INFORMATION/TIME
94
RECEIVE SHOT TRIGGER SIGNAL
<CONTROLLER>
POSITION INFORMATION /TIME
SIMULATION TRIGGER SIGNAL
TRANSMISSION TRIGGER SIGNAL
ID NUMBER WEAPON TYPE INFORMATION
93
SET ID NUMBER AND WEAPON TYPE
<ID NUMBER/ WEAPON TYPE SETTER>
SIMULATE SHOT
<SHOT SIMULATOR>
95
TRANSMIT SIMULATED SHOT LASER SIGNAL
<CONTROLLER>
96

Fig.10

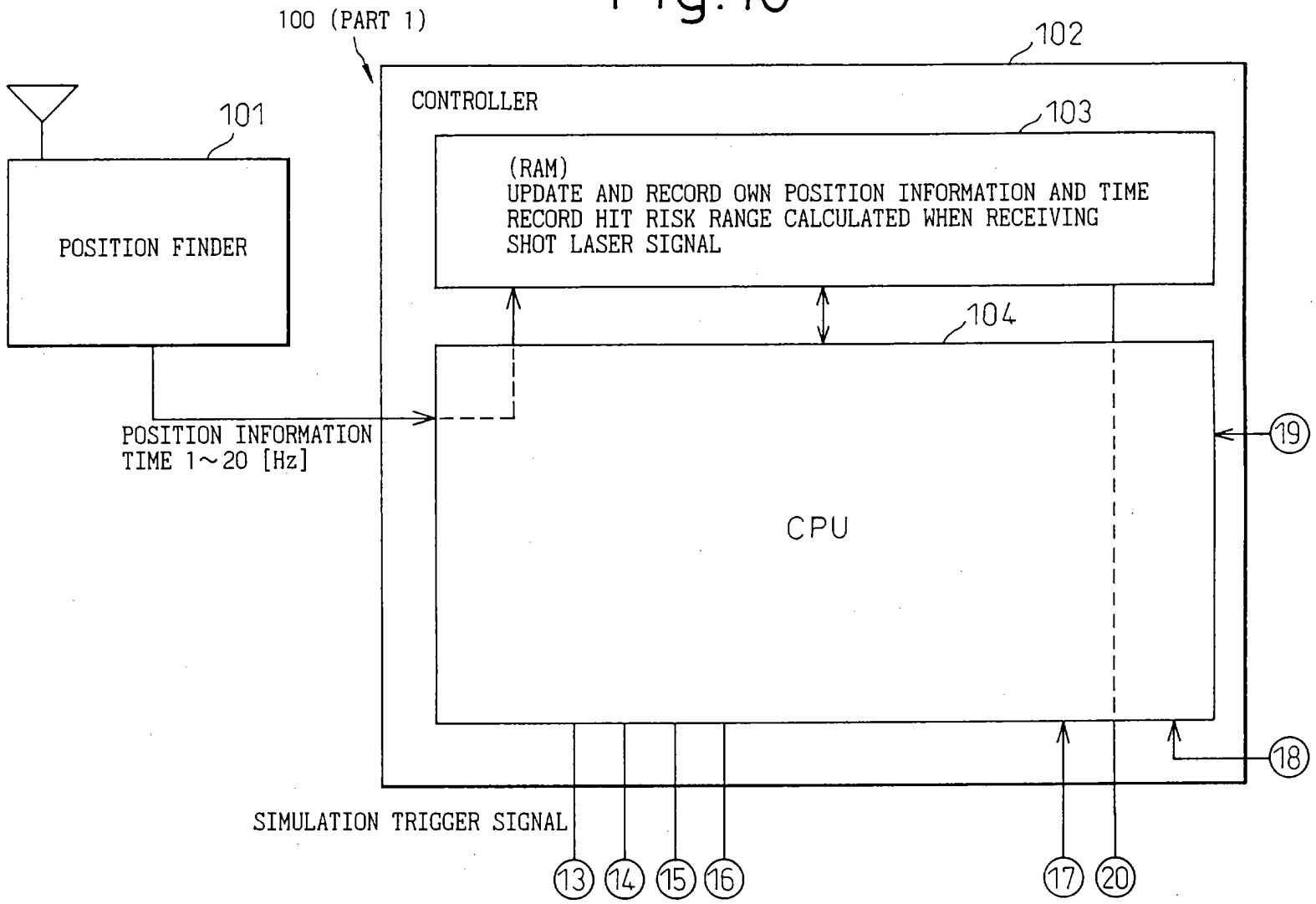

100 (PART 1)
102
CONTROLLER
101
103
POSITION FINDER
(RAM)
UPDATE AND RECORD OWN POSITION INFORMATION AND TIME
RECORD HIT RISK RANGE CALCULATED WHEN RECEIVING
SHOT LASER SIGNAL
104
POSITION INFORMATION
TIME 1~20 [Hz]
19
CPU
18
SIMULATION TRIGGER SIGNAL
13
14
15
16
17
20

Fig.11

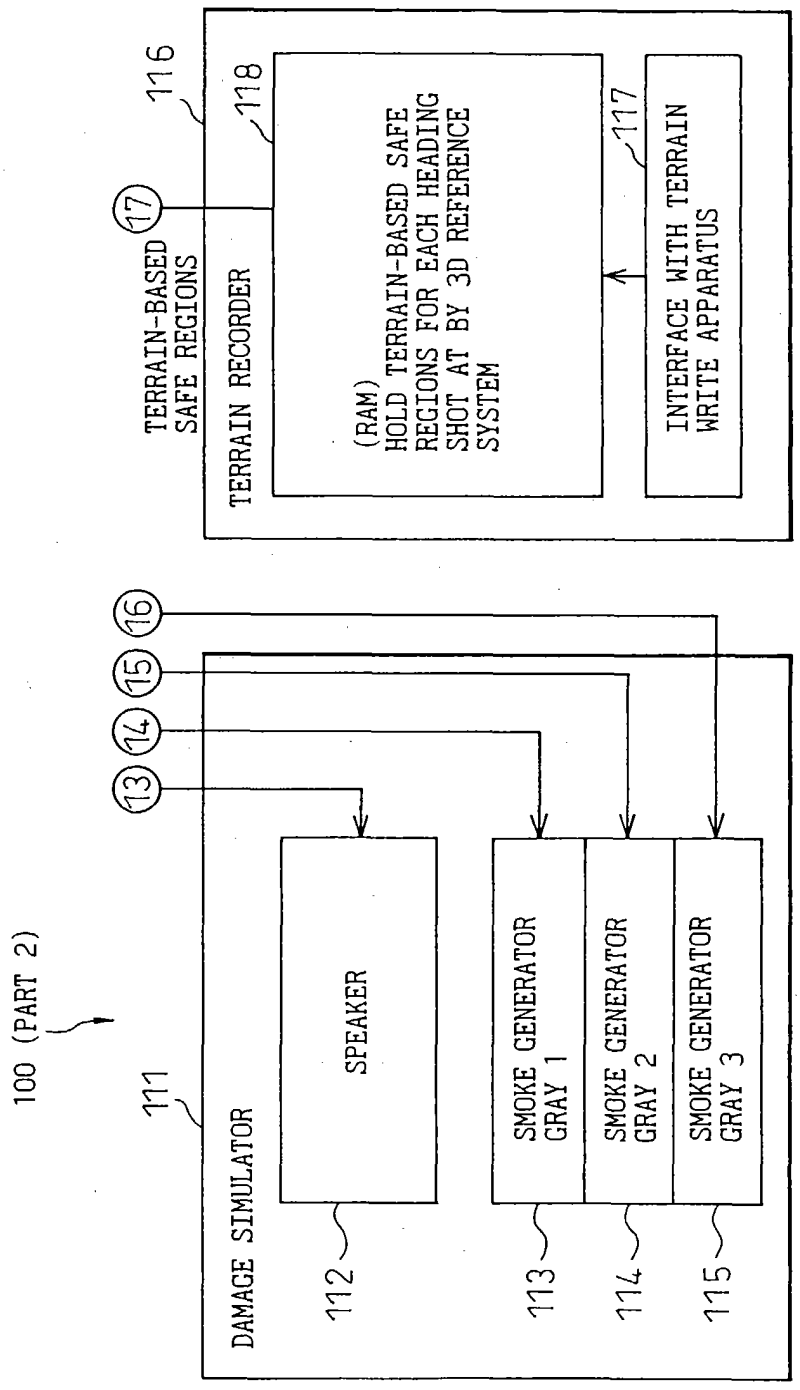

100 (PART 2)
111
DAMAGE SIMULATOR
SPEAKER
SMOKE GENERATOR GRAY 1
SMOKE GENERATOR GRAY 2
SMOKE GENERATOR GRAY 3
112
113
114
115
13
14
15
16
17
116
TERRAIN-BASED SAFE REGIONS
TERRAIN RECORDER
118
(RAM) HOLD TERRAIN-BASED SAFE REGIONS FOR EACH HEADING SHOT AT BY 3D REFERENCE SYSTEM
117
INTERFACE WITH TERRAIN WRITE APPARATUS

Fig.12

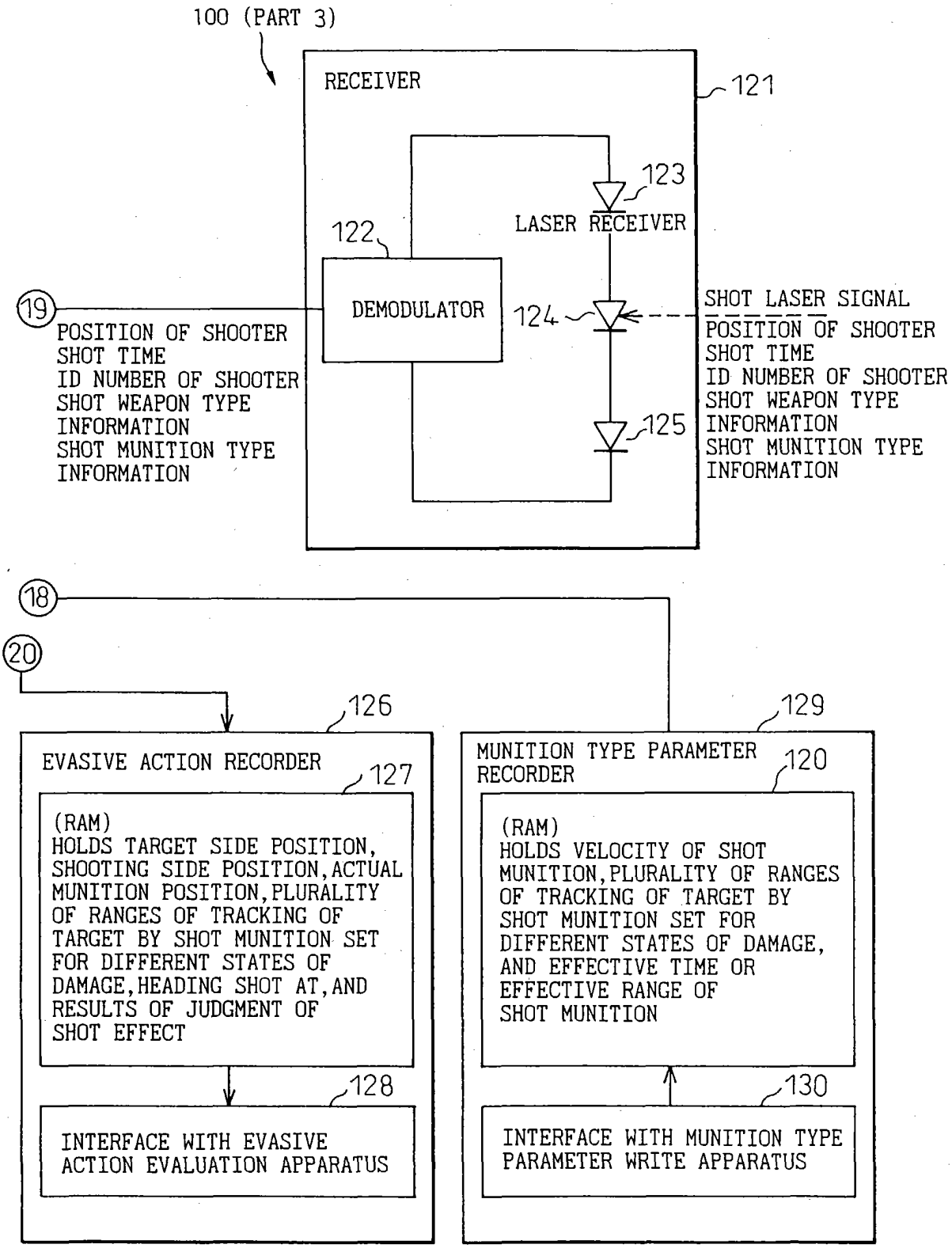

100 (PART 3)
RECEIVER
121
123
LASER RECEIVER
122
DEMODULATOR
124
125
19
POSITION OF SHOOTER
SHOT TIME
ID NUMBER OF SHOOTER
SHOT WEAPON TYPE INFORMATION
SHOT MUNITION TYPE INFORMATION
SHOT LASER SIGNAL
POSITION OF SHOOTER
SHOT TIME
ID NUMBER OF SHOOTER
SHOT WEAPON TYPE INFORMATION
SHOT MUNITION TYPE INFORMATION
18
20
126
EVASIVE ACTION RECORDER
127
(RAM)
HOLDS TARGET SIDE POSITION, SHOOTING SIDE POSITION, ACTUAL MUNITION POSITION, PLURALITY OF RANGES OF TRACKING OF TARGET BY SHOT MUNITION SET FOR DIFFERENT STATES OF DAMAGE, HEADING SHOT AT, AND RESULTS OF JUDGMENT OF SHOT EFFECT
128
INTERFACE WITH EVASIVE ACTION EVALUATION APPARATUS
129
MUNITION TYPE PARAMETER RECORDER
120
(RAM)
HOLDS VELOCITY OF SHOT MUNITION, PLURALITY OF RANGES OF TRACKING OF TARGET BY SHOT MUNITION SET FOR DIFFERENT STATES OF DAMAGE, AND EFFECTIVE TIME OR EFFECTIVE RANGE OF SHOT MUNITION
130
INTERFACE WITH MUNITION TYPE PARAMETER WRITE APPARATUS

Fig.13

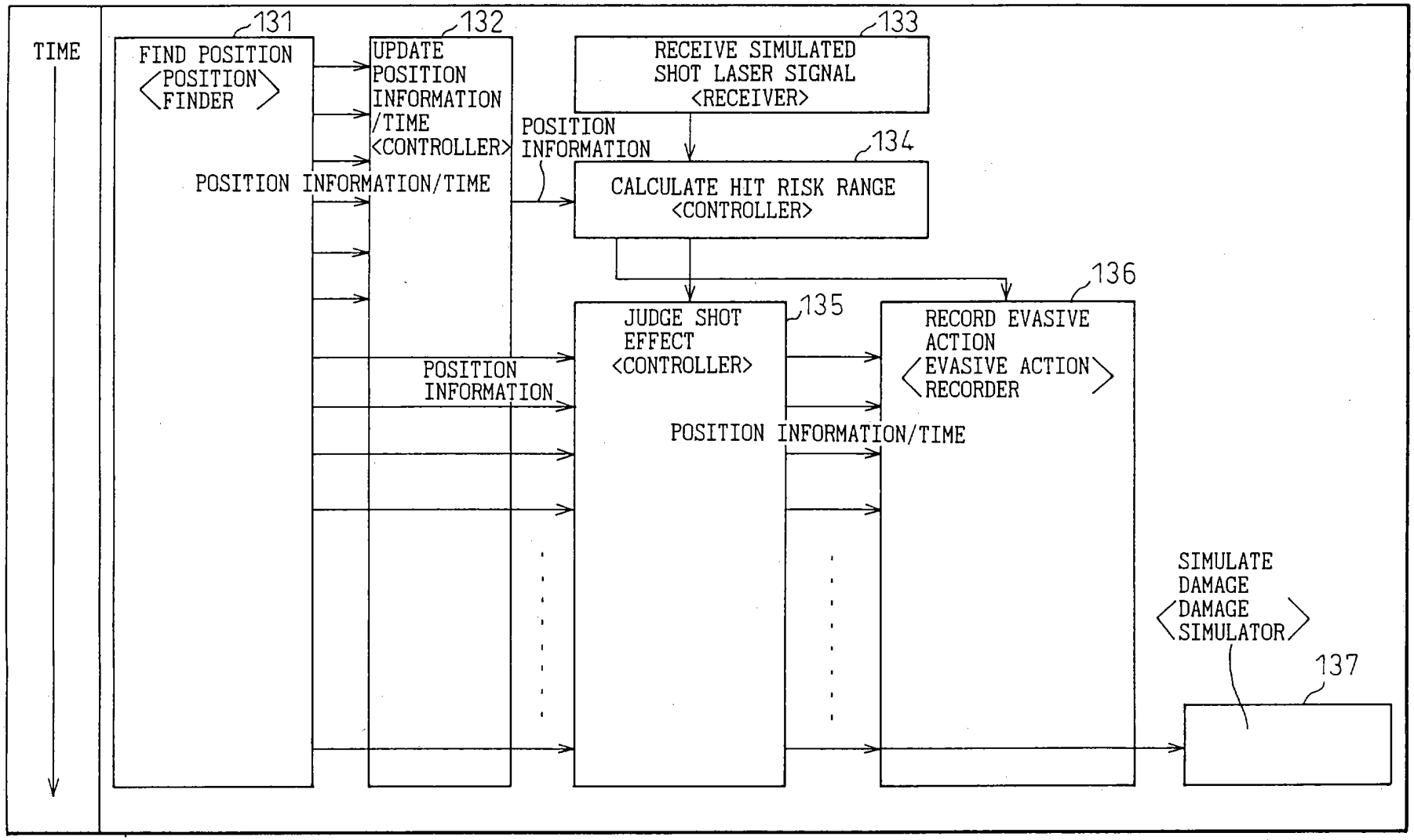

TIME
131
FIND POSITION
<POSITION FINDER>
132
UPDATE POSITION INFORMATION /TIME
<CONTROLLER>
133
RECEIVE SIMULATED SHOT LASER SIGNAL
<RECEIVER>
POSITION INFORMATION
134
CALCULATE HIT RISK RANGE
<CONTROLLER>
POSITION INFORMATION/TIME
136
135
JUDGE SHOT EFFECT
<CONTROLLER>
RECORD EVASIVE ACTION
<EVASIVE ACTION RECORDER>
POSITION INFORMATION
POSITION INFORMATION/TIME
SIMULATE DAMAGE
<DAMAGE SIMULATOR>
137

Fig.14

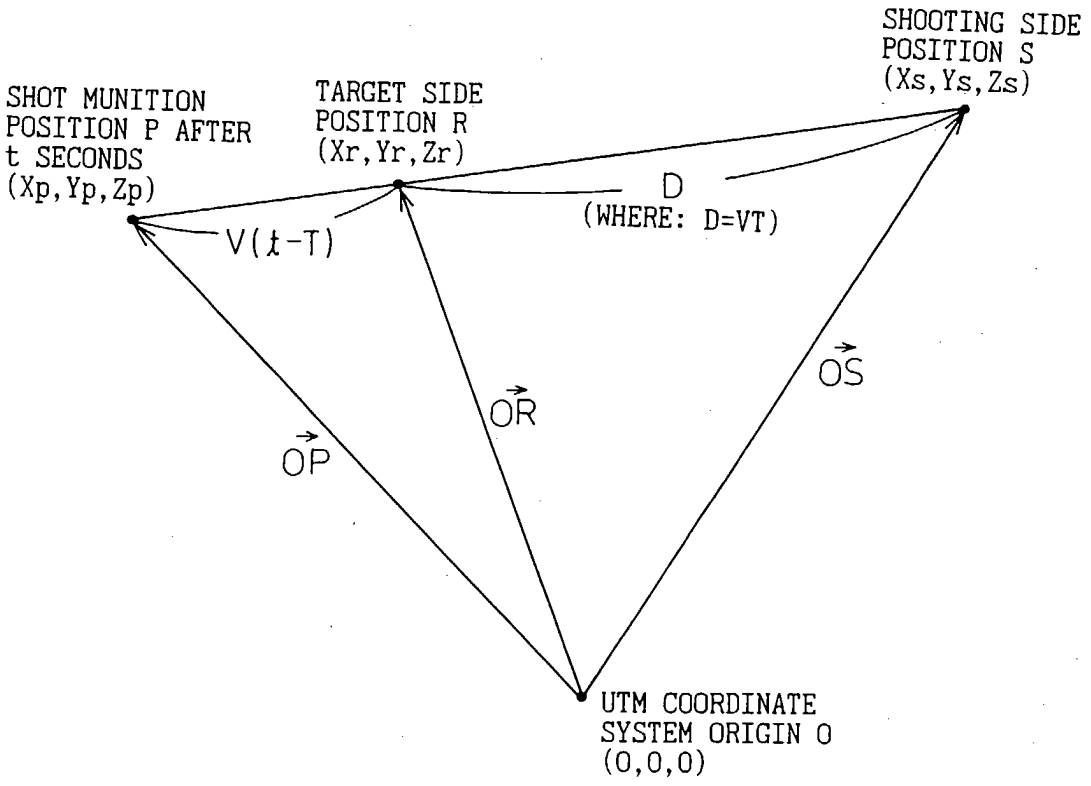

SHOOTING SIDE
POSITION S
(Xs,Ys,Zs)
SHOT MUNITION
POSITION P AFTER
t SECONDS
(Xp,Yp,Zp)
TARGET SIDE
POSITION R
(Xr,Yr,Zr)
D
(WHERE: D=VT)
V(t-T)
OS
OR
OP
UTM COORDINATE
SYSTEM ORIGIN O
(0,0,0)

Fig.15

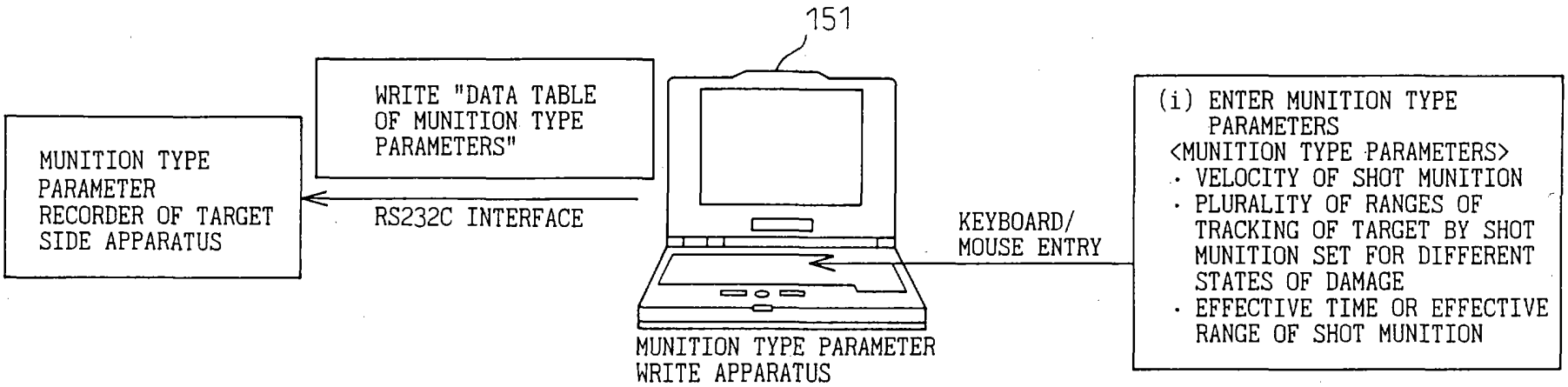

151
WRITE "DATA TABLE OF MUNITION TYPE PARAMETERS"
MUNITION TYPE PARAMETER RECORDER OF TARGET SIDE APPARATUS
RS232C INTERFACE
KEYBOARD/ MOUSE ENTRY
(i) ENTER MUNITION TYPE PARAMETERS
<MUNITION TYPE PARAMETERS>
· VELOCITY OF SHOT MUNITION
· PLURALITY OF RANGES OF TRACKING OF TARGET BY SHOT MUNITION SET FOR DIFFERENT STATES OF DAMAGE
· EFFECTIVE TIME OR EFFECTIVE RANGE OF SHOT MUNITION
MUNITION TYPE PARAMETER WRITE APPARATUS
<SOFTWARE PROCESSING>
(i) PREPARE DATA TABLE OF MUNITION TYPE PARAMETERS

Fig.16

161

CALCULATE DISTANCE D BETWEEN SHOOTING SIDE AND TARGET SIDE IN 3D REFERENCE SYSTEM AT TIME WHEN TARGET SIDE APPARATUS RECEIVES SHOT LASER SIGNAL

$$D=\sqrt{(Xr-Xs)^2+(Yr-Ys)^2+(Zr-Zs)^2}$$

162

CALCULATE EXPECTED POSITION OF SHOT MUNITION FOR EVERY ELAPSE OF TIME FROM TIME WHEN TARGET SIDE APPARATUS RECEIVES SHOT LASER SIGNAL TO EFFECTIVE TIME Te OF SHOT MUNITION BASED ON CALCULATED DISTANCE D.

$$\vec{OP}=\frac{\{V(t-T)+D\}\vec{OR}-\{V(t-T)\}\vec{OS}}{-\{V(t-T)\}+\{V(t-T)+D\}}$$

FROM,
POSITION P (Xp,Yp,Zp) OF SHOT MUNITION AFTER t SECONDS AFTER SHOT BECOMES AS FOLLOWS:

$$\begin{cases} Xp=\dfrac{\{V(t-T)+D\}Xr-\{V(t-T)\}Xs}{-\{V(t-T)\}+\{V(t-T)+D\}} \\ Yp=\dfrac{\{V(t-T)+D\}Yr-\{V(t-T)\}Ys}{-\{V(t-T)\}+\{V(t-T)+D\}} \\ Zp=\dfrac{\{V(t-T)+D\}Zr-\{V(t-T)\}Zs}{-\{V(t-T)\}+\{V(t-T)+D\}} \end{cases}$$

163

CALCULATE HIT RISK RANGE FOR EVERY ELAPSE OF TIME BASED ON EXPECTED POSITION OF SHOT MUNITION FOR EVERY ELAPSE OF TIME

EXTENT OF DAMAGE

HIT RISK RANGE AFTER t SECONDS BECOMES AS IN FOLLOWING TABLE FOR EACH STATE OF DAMAGE (r1>r2>r3>r4)

	HIT RISK RANGE
NEAR MISS	RANGE OF RADIUS r1 TO r2 ABOUT POSITION P (Xp,Yp,Zp) OF SHOT MUNITION
SMALL DAMAGE	RANGE OF RADIUS r2 TO r3 ABOUT POSITION P (Xp,Yp,Zp) OF SHOT MUNITION
MEDIUM DAMAGTE	RANGE OF RADIUS r3 TO r4 ABOUT POSITION P (Xp,Yp,Zp) OF SHOT MUNITION
LARGE DAMAGE	RANGE OF LESS THAN RADIUS r4 ABOUT POSITION P (Xp,Yp,Zp) OF SHOT MUNITION

Fig.17

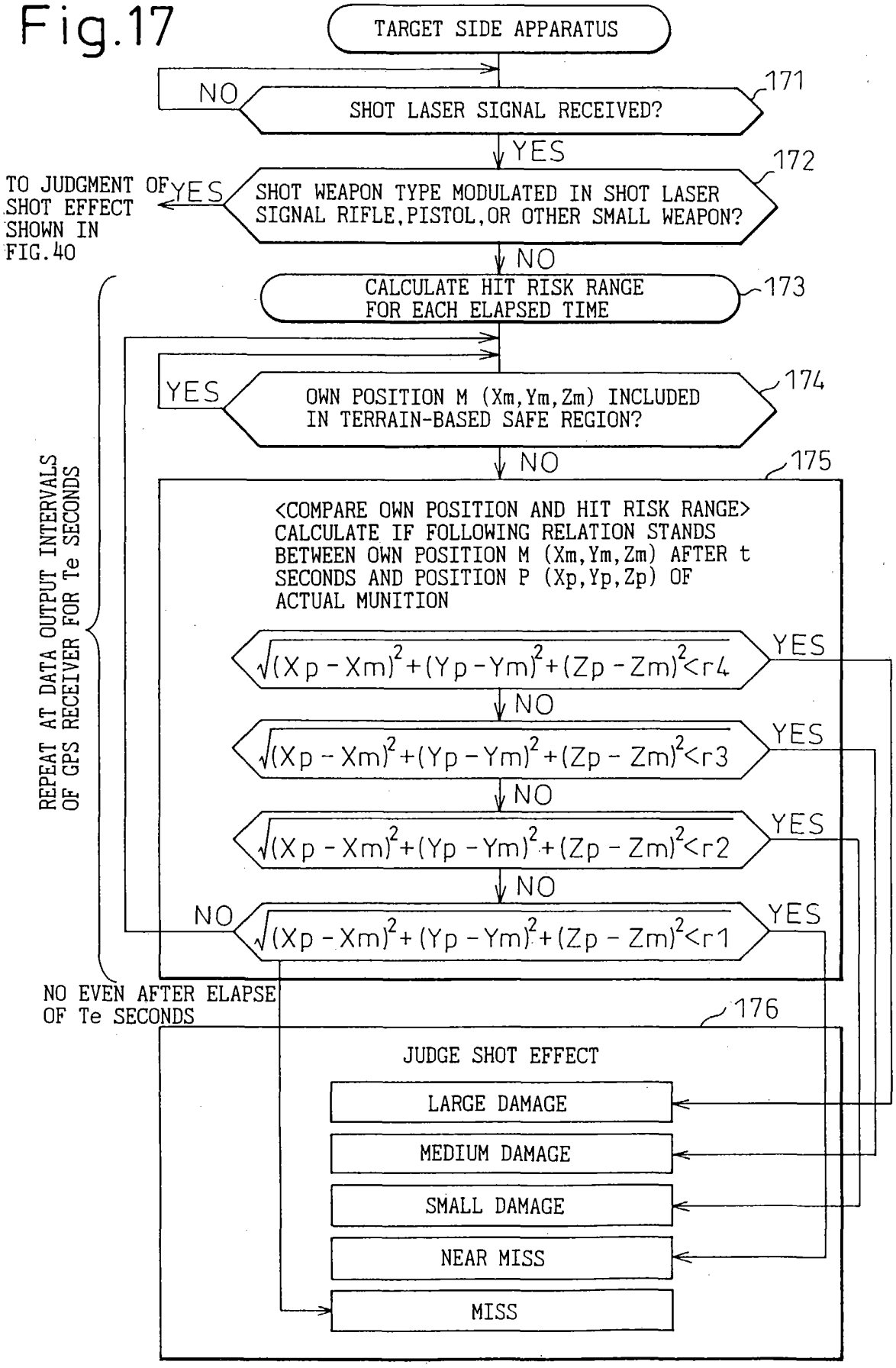

TARGET SIDE APPARATUS
NO
SHOT LASER SIGNAL RECEIVED?
171
YES
TO JUDGMENT OF SHOT EFFECT SHOWN IN FIG.40
YES
SHOT WEAPON TYPE MODULATED IN SHOT LASER SIGNAL RIFLE,PISTOL,OR OTHER SMALL WEAPON?
172
NO
CALCULATE HIT RISK RANGE FOR EACH ELAPSED TIME
173
YES
OWN POSITION M (Xm,Ym,Zm) INCLUDED IN TERRAIN-BASED SAFE REGION?
174
NO
175
<COMPARE OWN POSITION AND HIT RISK RANGE>
CALCULATE IF FOLLOWING RELATION STANDS BETWEEN OWN POSITION M (Xm,Ym,Zm) AFTER t SECONDS AND POSITION P (Xp,Yp,Zp) OF ACTUAL MUNITION
$\sqrt{(Xp-Xm)^2+(Yp-Ym)^2+(Zp-Zm)^2}<r4$
YES
NO
$\sqrt{(Xp-Xm)^2+(Yp-Ym)^2+(Zp-Zm)^2}<r3$
YES
NO
$\sqrt{(Xp-Xm)^2+(Yp-Ym)^2+(Zp-Zm)^2}<r2$
YES
NO
NO
$\sqrt{(Xp-Xm)^2+(Yp-Ym)^2+(Zp-Zm)^2}<r1$
YES
REPEAT AT DATA OUTPUT INTERVALS OF GPS RECEIVER FOR Te SECONDS
NO EVEN AFTER ELAPSE OF Te SECONDS
176
JUDGE SHOT EFFECT
LARGE DAMAGE
MEDIUM DAMAGE
SMALL DAMAGE
NEAR MISS
MISS

Fig.18

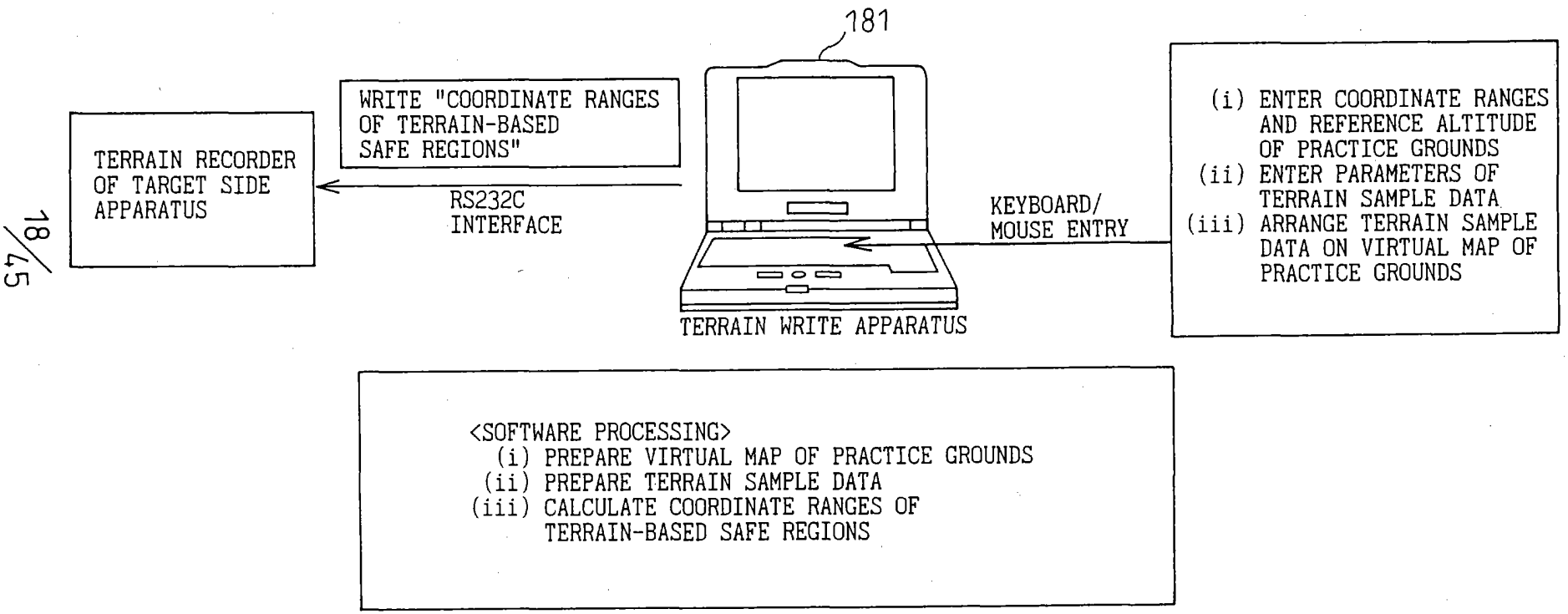

181
TERRAIN RECORDER OF TARGET SIDE APPARATUS
WRITE "COORDINATE RANGES OF TERRAIN-BASED SAFE REGIONS"
RS232C INTERFACE
KEYBOARD/ MOUSE ENTRY
(i) ENTER COORDINATE RANGES AND REFERENCE ALTITUDE OF PRACTICE GROUNDS
(ii) ENTER PARAMETERS OF TERRAIN SAMPLE DATA
(iii) ARRANGE TERRAIN SAMPLE DATA ON VIRTUAL MAP OF PRACTICE GROUNDS
TERRAIN WRITE APPARATUS
<SOFTWARE PROCESSING>
(i) PREPARE VIRTUAL MAP OF PRACTICE GROUNDS
(ii) PREPARE TERRAIN SAMPLE DATA
(iii) CALCULATE COORDINATE RANGES OF TERRAIN-BASED SAFE REGIONS

Fig. 19

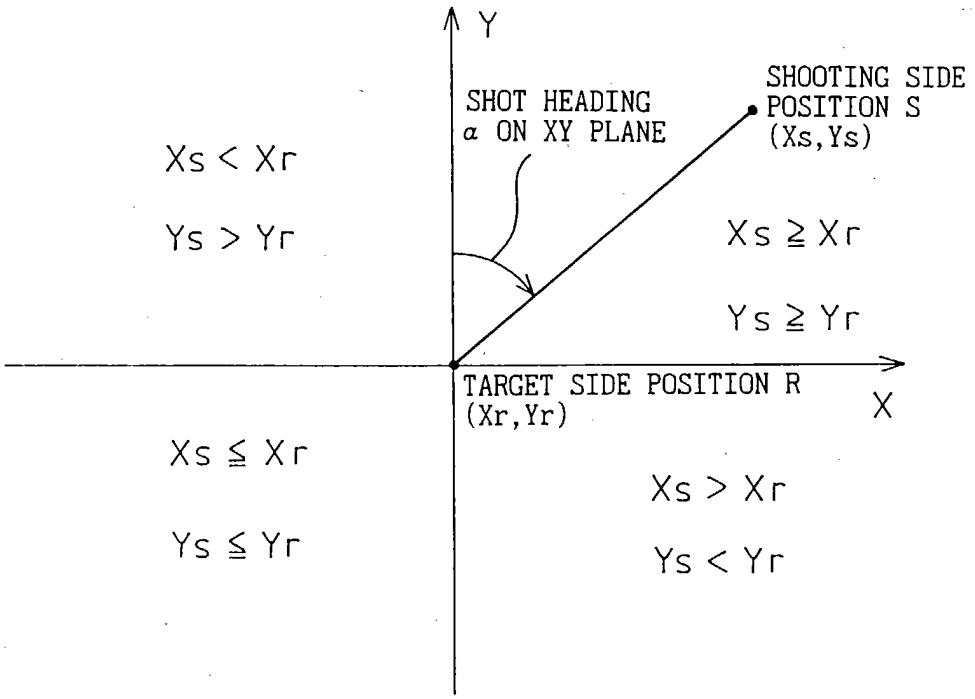

Y
SHOOTING SIDE POSITION S (Xs, Ys)
SHOT HEADING α ON XY PLANE
Xs < Xr
Ys > Yr
Xs ≧ Xr
Ys ≧ Yr
TARGET SIDE POSITION R (Xr, Yr)
X
Xs ≦ Xr
Ys ≦ Yr
Xs > Xr
Ys < Yr

Fig. 20

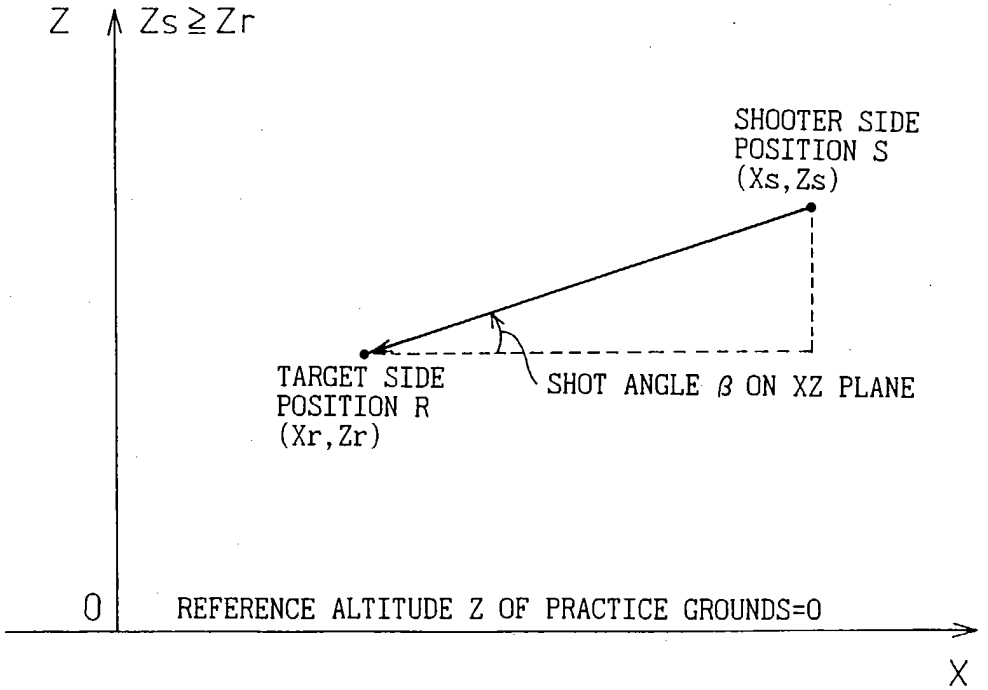

Z
Zs ≧ Zr
SHOOTER SIDE POSITION S (Xs, Zs)
TARGET SIDE POSITION R (Xr, Zr)
SHOT ANGLE β ON XZ PLANE
0
REFERENCE ALTITUDE Z OF PRACTICE GROUNDS=0
X

Fig.21

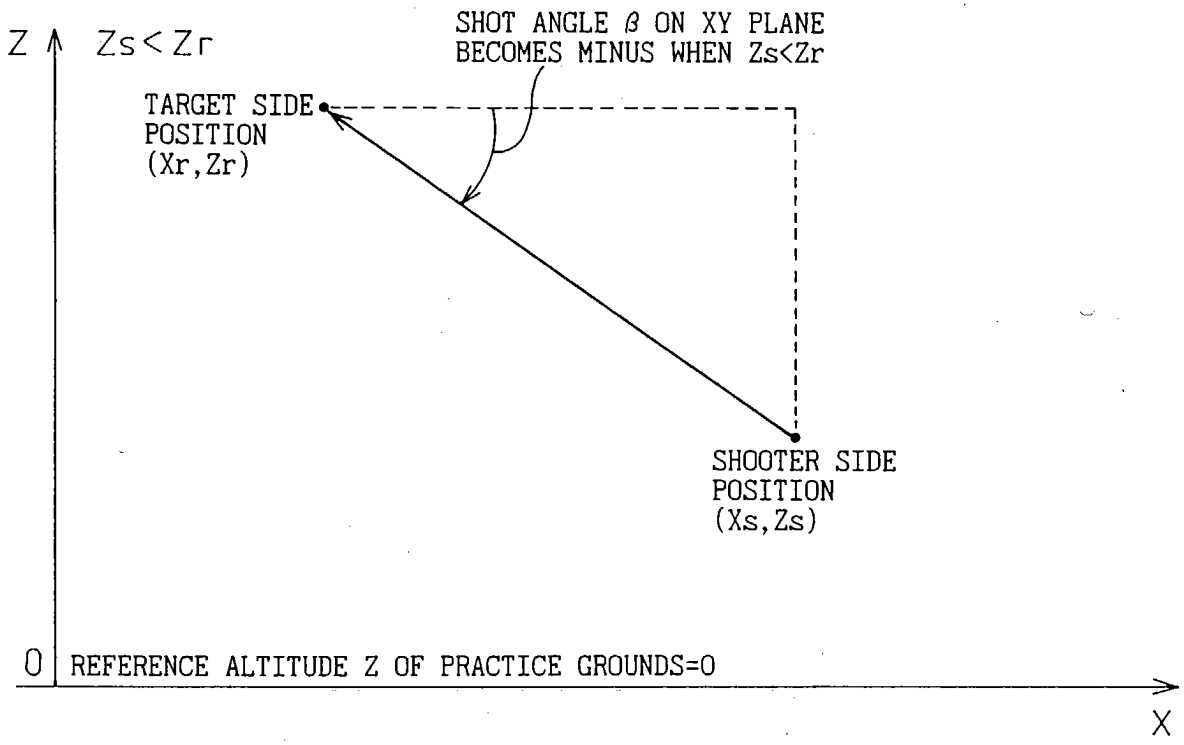

Z
Zs<Zr
SHOT ANGLE β ON XY PLANE
BECOMES MINUS WHEN Zs<Zr
TARGET SIDE
POSITION
(Xr,Zr)
SHOOTER SIDE
POSITION
(Xs,Zs)
0
REFERENCE ALTITUDE Z OF PRACTICE GROUNDS=0
X

Fig. 22

221

CALCULATE DISTANCE Dxy BETWEEN SHOOTING SIDE AND TARGET SIDE ON XY PLANE WHEN TARGET SIDE RECEIVES SHOT LASER SIGNAL

$$Dxy = \sqrt{(Xr - Xs)^2 + (Yr - Ys)^2}$$

222

CALCULATE IN WHAT QUADRANT ON XY PLANE SHOOTING SIDE APPARATUS IS IN USING POSITION OF SHOOTING SIDE ON XY PLANE AS ORIGIN O

CONDITION	QUADRANT
$Xs \geqq Xr$ AND $Ys \geqq Yr$	1ST QUADRANT
$Xs > Xr$ AND $Ys < Yr$	2ND QUADRANT
$Xs \leqq Xr$ AND $Ys \leqq Yr$	3RD QUADRANT
$Xs < Xr$ AND $Ys > Yr$	4TH QUADRANT

223

CALCULATE SHOT HEADING α ON XY PLANE USING DISTANCE Dxy BETWEEN SHOOTING SIDE AND TARGET SIDE ON XY PLANE FROM FORMULA SET FOR EACH CORRESPONDING QUADRANT

QUADRANT	FORMULA FOR CALCULATION OF SHOTH EADING α ON XY PLANE
1ST QUADRANT	$\alpha = 90° - (\cos^{-1}\frac{\lvert Xs - Xr\rvert}{Dxy}) \times \frac{180}{\pi}$
2ND QUADRANT	$\alpha = 90° + (\cos^{-1}\frac{\lvert Xs - Xr\rvert}{Dxy}) \times \frac{180}{\pi}$
3RD QUADRANT	$\alpha = 270° - (\cos^{-1}\frac{\lvert Xs - Xr\rvert}{Dxy}) \times \frac{180}{\pi}$
4TH QUADRANT	$\alpha = 270° + (\cos^{-1}\frac{\lvert Xs - Xr\rvert}{Dxy}) \times \frac{180}{\pi}$

Fig. 23

CALCULATE SHOT ANGLE β ON XZ PLANE BY FOLLOWING FORMULA:

$$\beta = \sin^{-1}\left(\frac{(Zs - Zr)}{\sqrt{(Xs - Xr)^2 + (Zs - Zr)^2}}\right) \times \frac{180}{\pi}$$

Fig.24

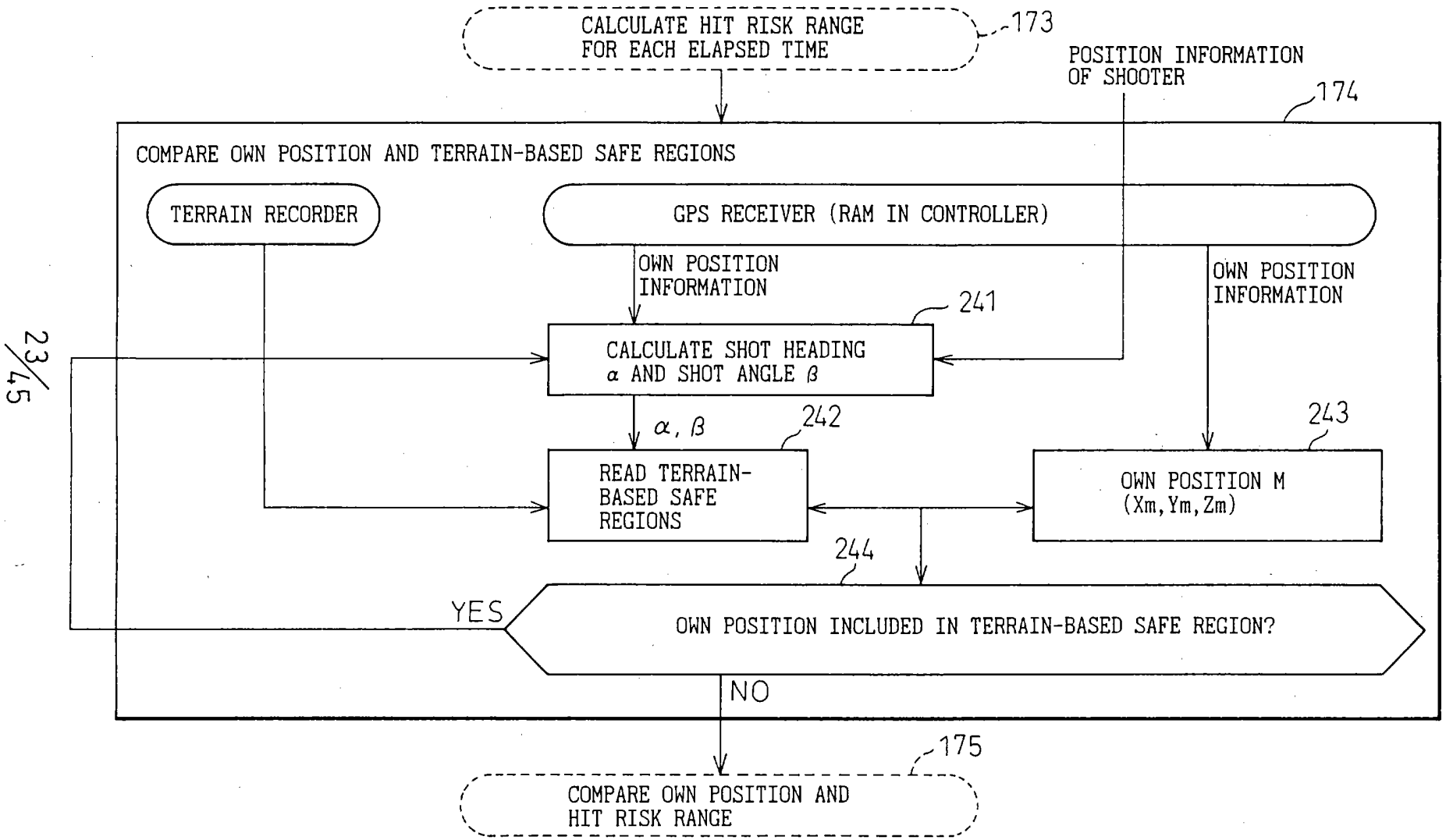

CALCULATE HIT RISK RANGE FOR EACH ELAPSED TIME
173
POSITION INFORMATION OF SHOOTER
174
COMPARE OWN POSITION AND TERRAIN-BASED SAFE REGIONS
TERRAIN RECORDER
GPS RECEIVER (RAM IN CONTROLLER)
OWN POSITION INFORMATION
OWN POSITION INFORMATION
241
CALCULATE SHOT HEADING α AND SHOT ANGLE β
α, β
242
243
READ TERRAIN-BASED SAFE REGIONS
OWN POSITION M (Xm, Ym, Zm)
244
YES
OWN POSITION INCLUDED IN TERRAIN-BASED SAFE REGION?
NO
175
COMPARE OWN POSITION AND HIT RISK RANGE

Fig.25

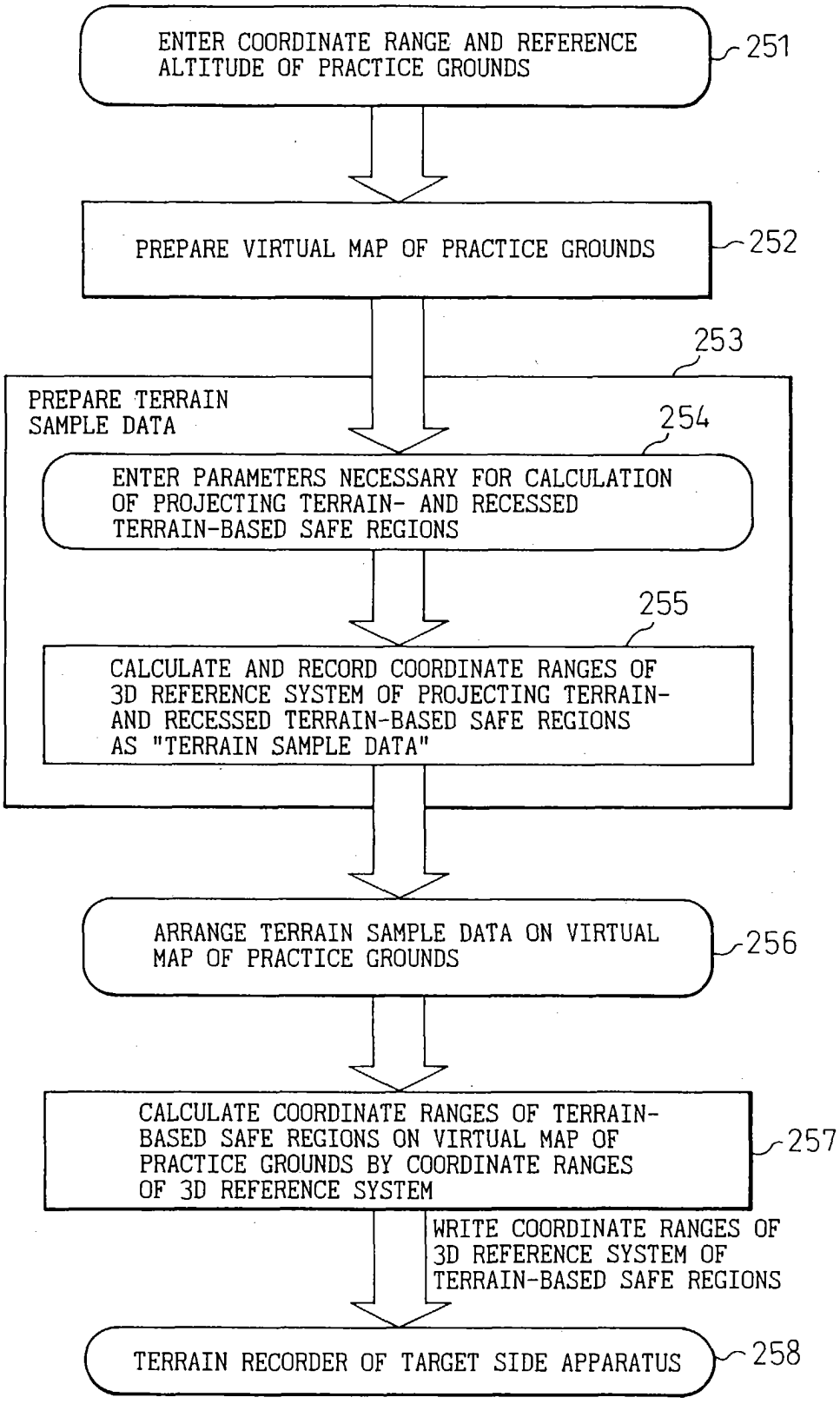

ENTER COORDINATE RANGE AND REFERENCE ALTITUDE OF PRACTICE GROUNDS
251
PREPARE VIRTUAL MAP OF PRACTICE GROUNDS
252
253
PREPARE TERRAIN SAMPLE DATA
254
ENTER PARAMETERS NECESSARY FOR CALCULATION OF PROJECTING TERRAIN- AND RECESSED TERRAIN-BASED SAFE REGIONS
255
CALCULATE AND RECORD COORDINATE RANGES OF 3D REFERENCE SYSTEM OF PROJECTING TERRAIN- AND RECESSED TERRAIN-BASED SAFE REGIONS AS "TERRAIN SAMPLE DATA"
ARRANGE TERRAIN SAMPLE DATA ON VIRTUAL MAP OF PRACTICE GROUNDS
256
CALCULATE COORDINATE RANGES OF TERRAIN-BASED SAFE REGIONS ON VIRTUAL MAP OF PRACTICE GROUNDS BY COORDINATE RANGES OF 3D REFERENCE SYSTEM
257
WRITE COORDINATE RANGES OF 3D REFERENCE SYSTEM OF TERRAIN-BASED SAFE REGIONS
TERRAIN RECORDER OF TARGET SIDE APPARATUS
258

Fig. 26

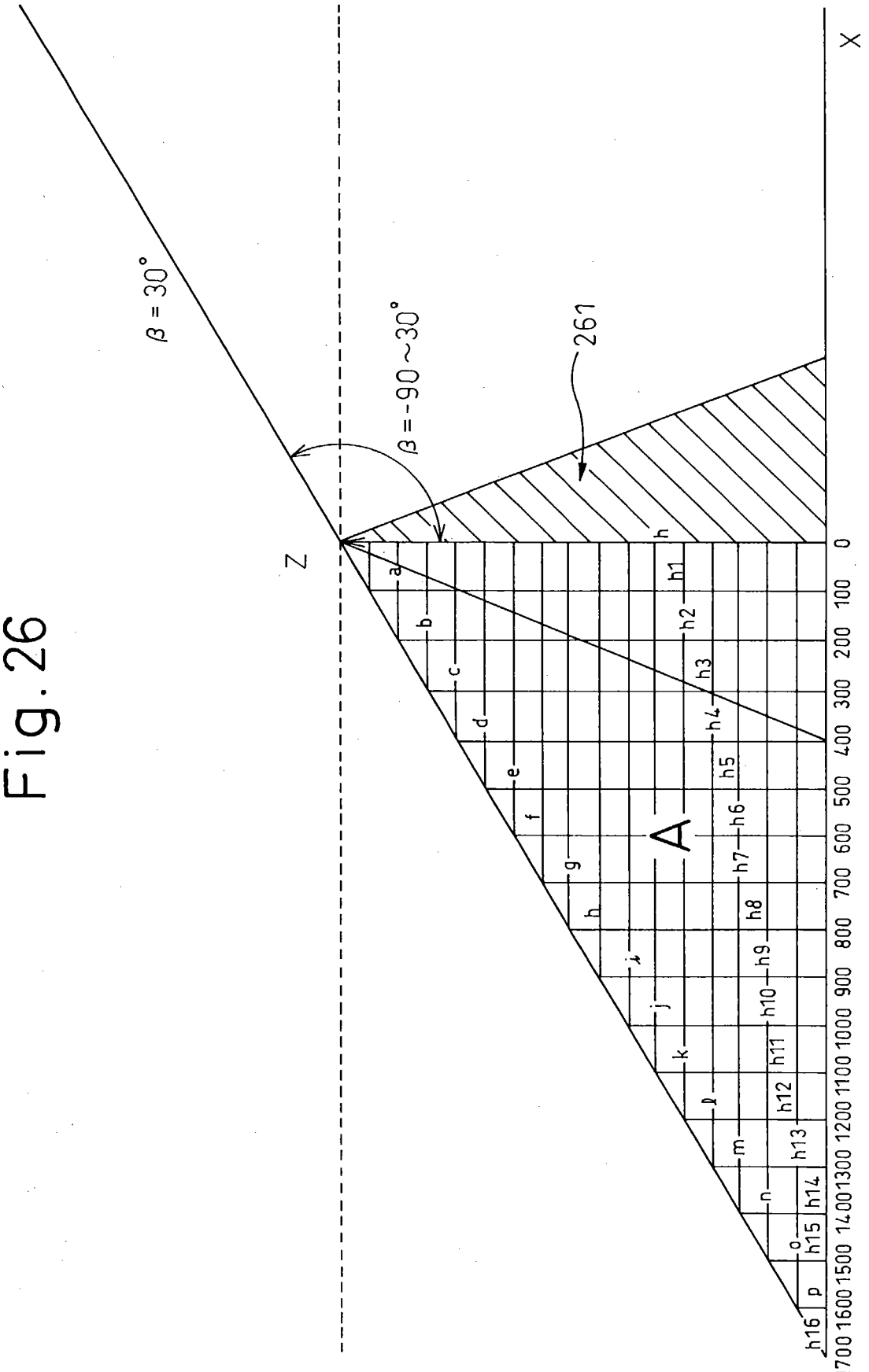

β = 30°
β = -90~30°
261
Z
X
A
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
h1
h2
h3
h4
h5
h6
h7
h8
h9
h10
h11
h12
h13
h14
h15
h16
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700

Fig.27

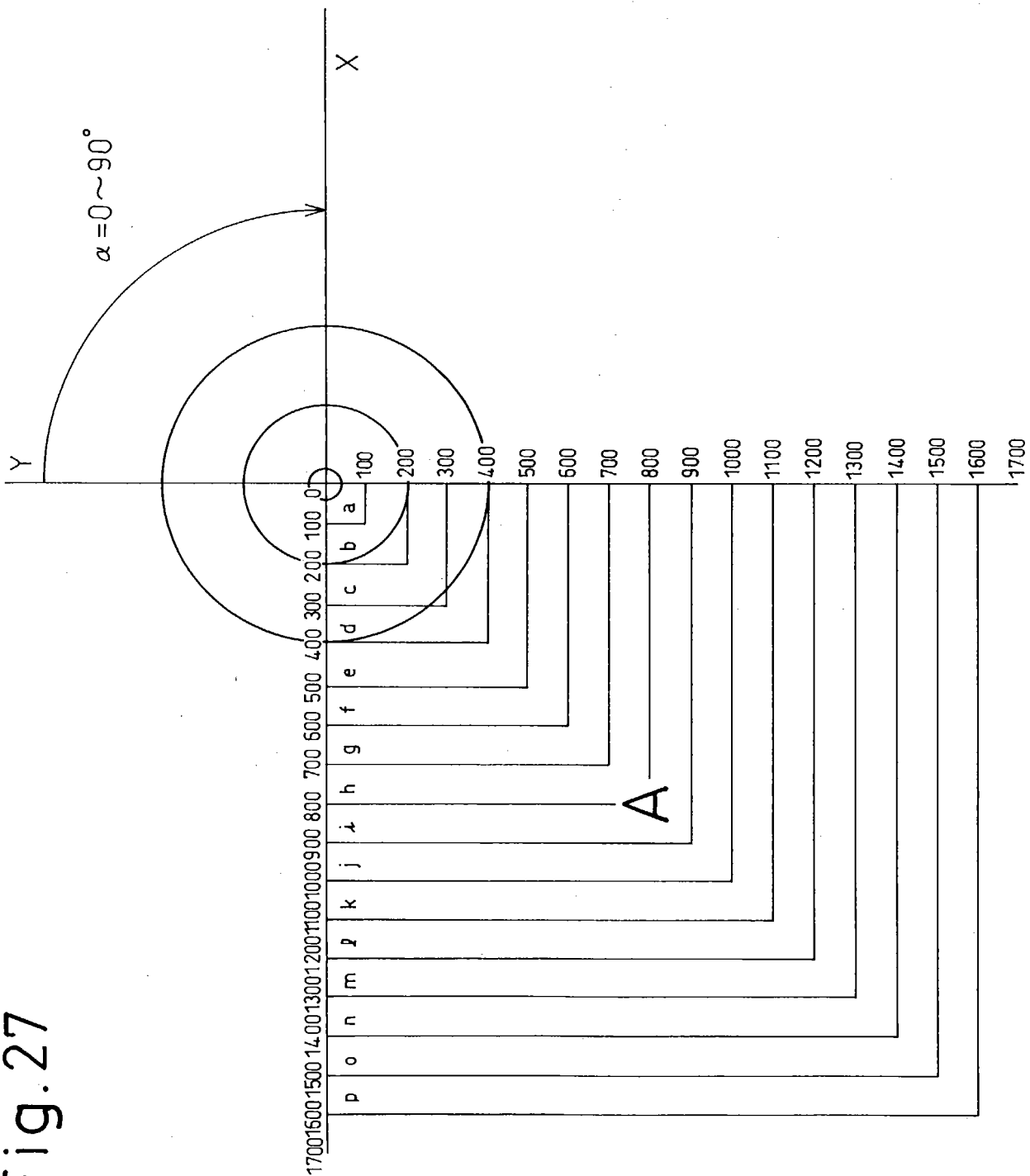

α=0~90°
Y
X
A
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700

Fig.28

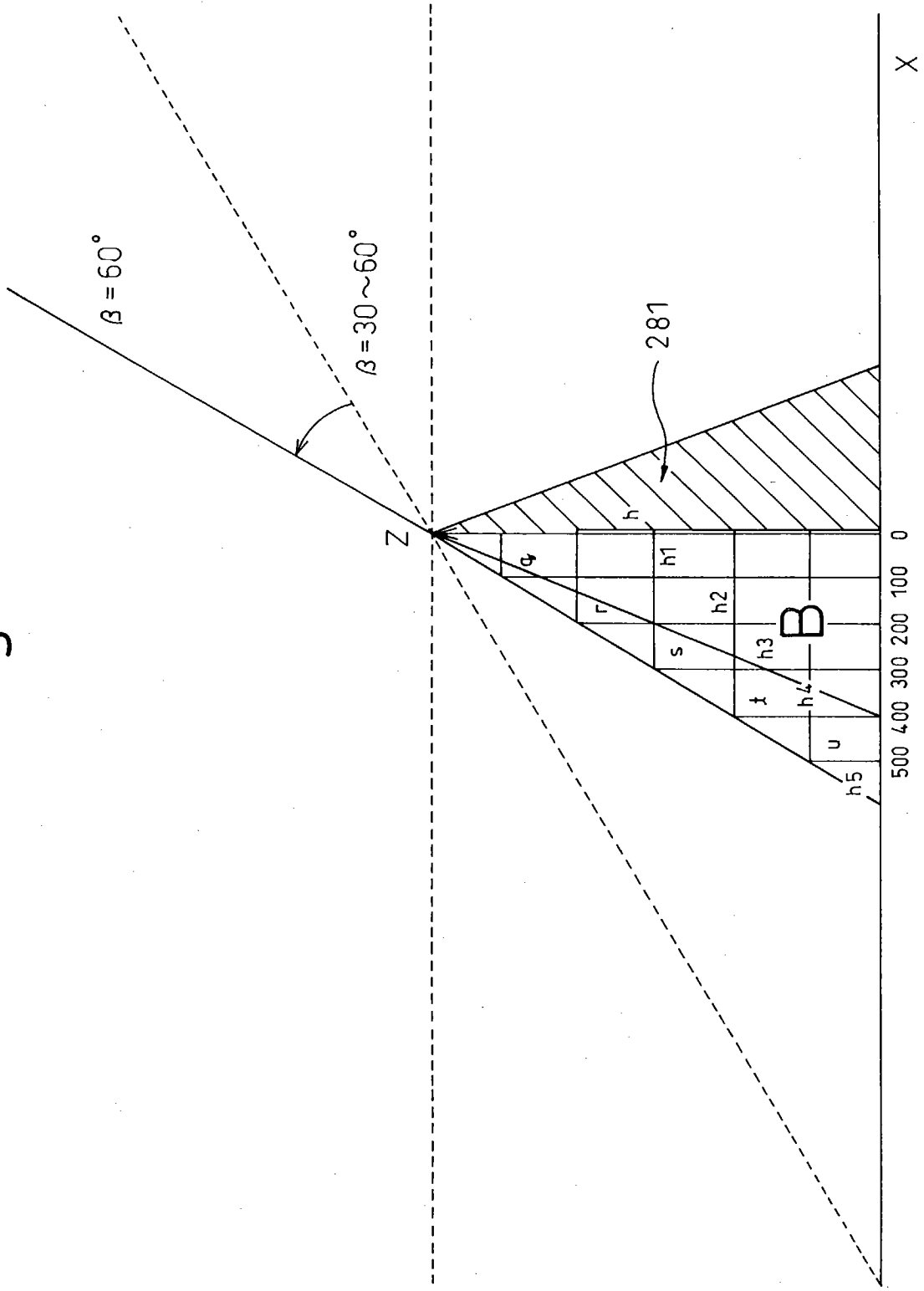


Fig.29

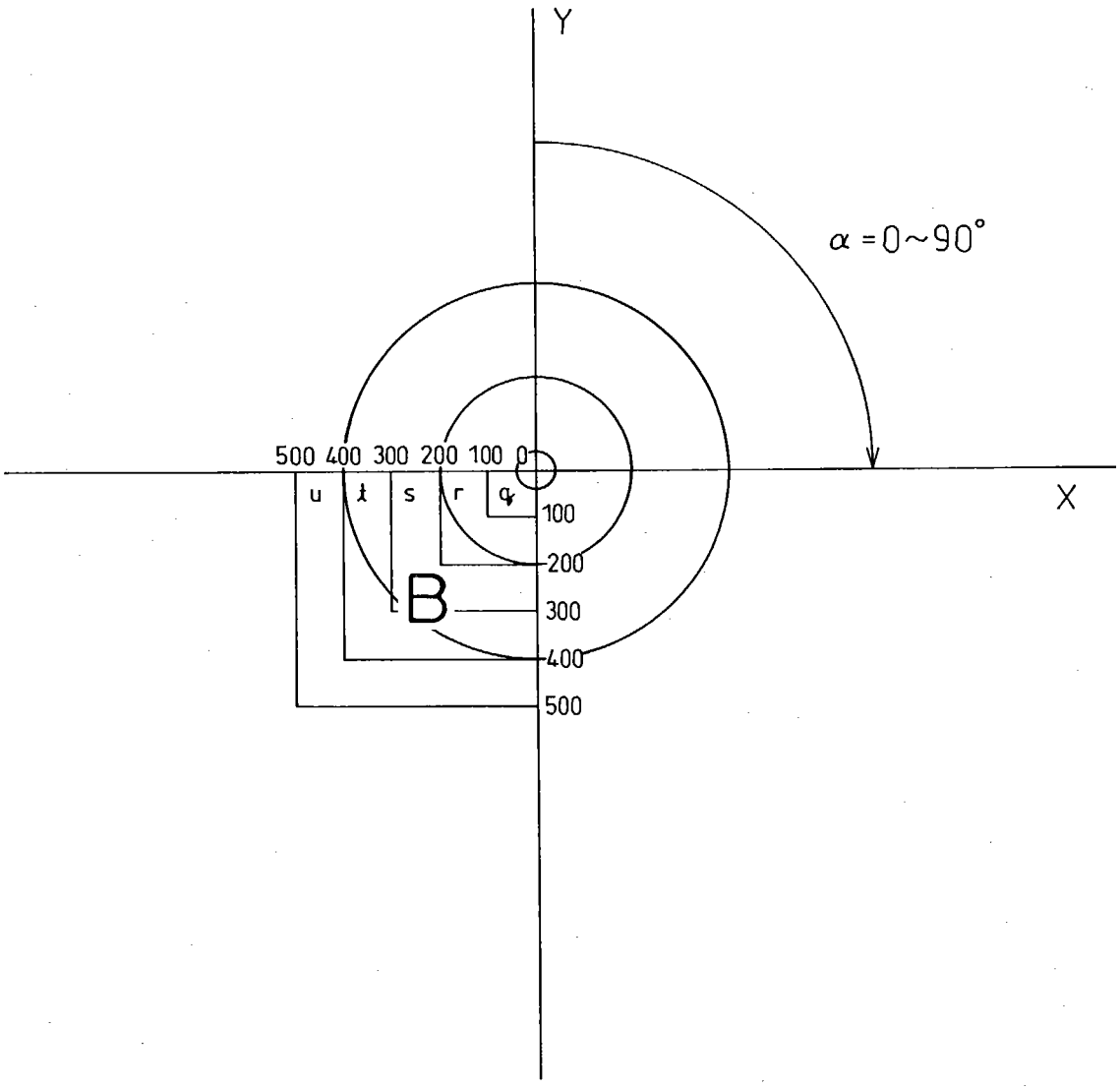


Fig.30

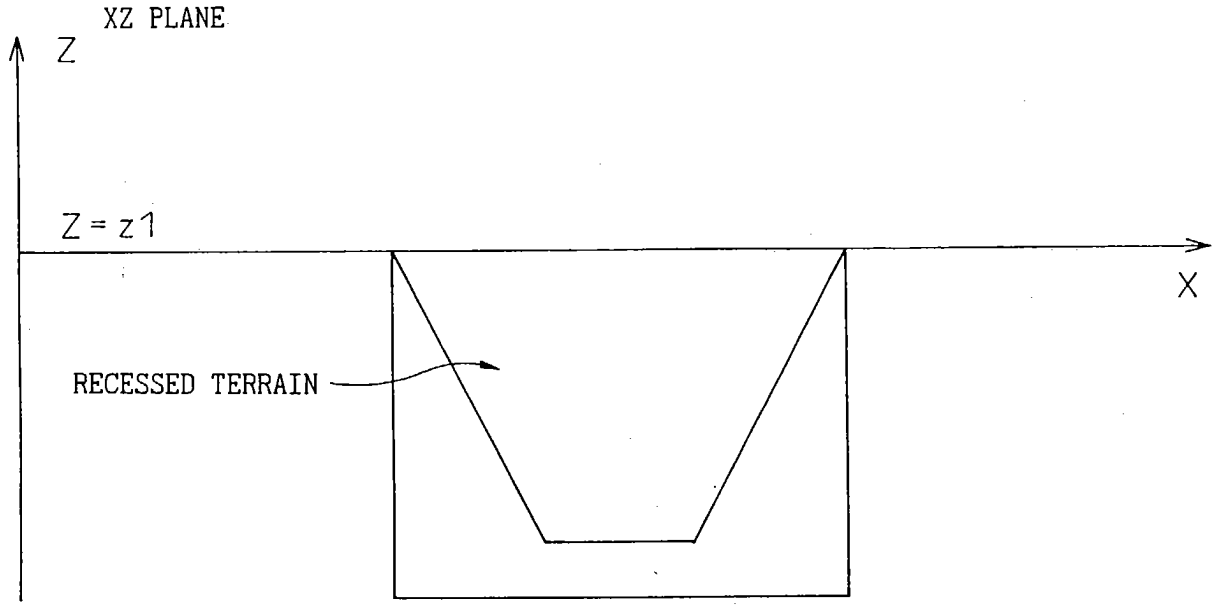

XZ PLANE
Z
Z = z1
X
RECESSED TERRAIN

Fig.31

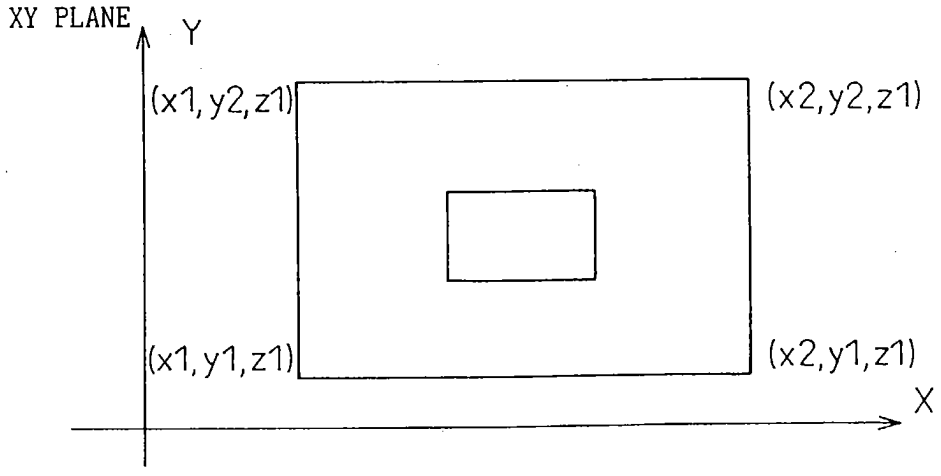

XY PLANE
Y
(x1, y2, z1)
(x2, y2, z1)
(x1, y1, z1)
(x2, y1, z1)
X

Fig.32

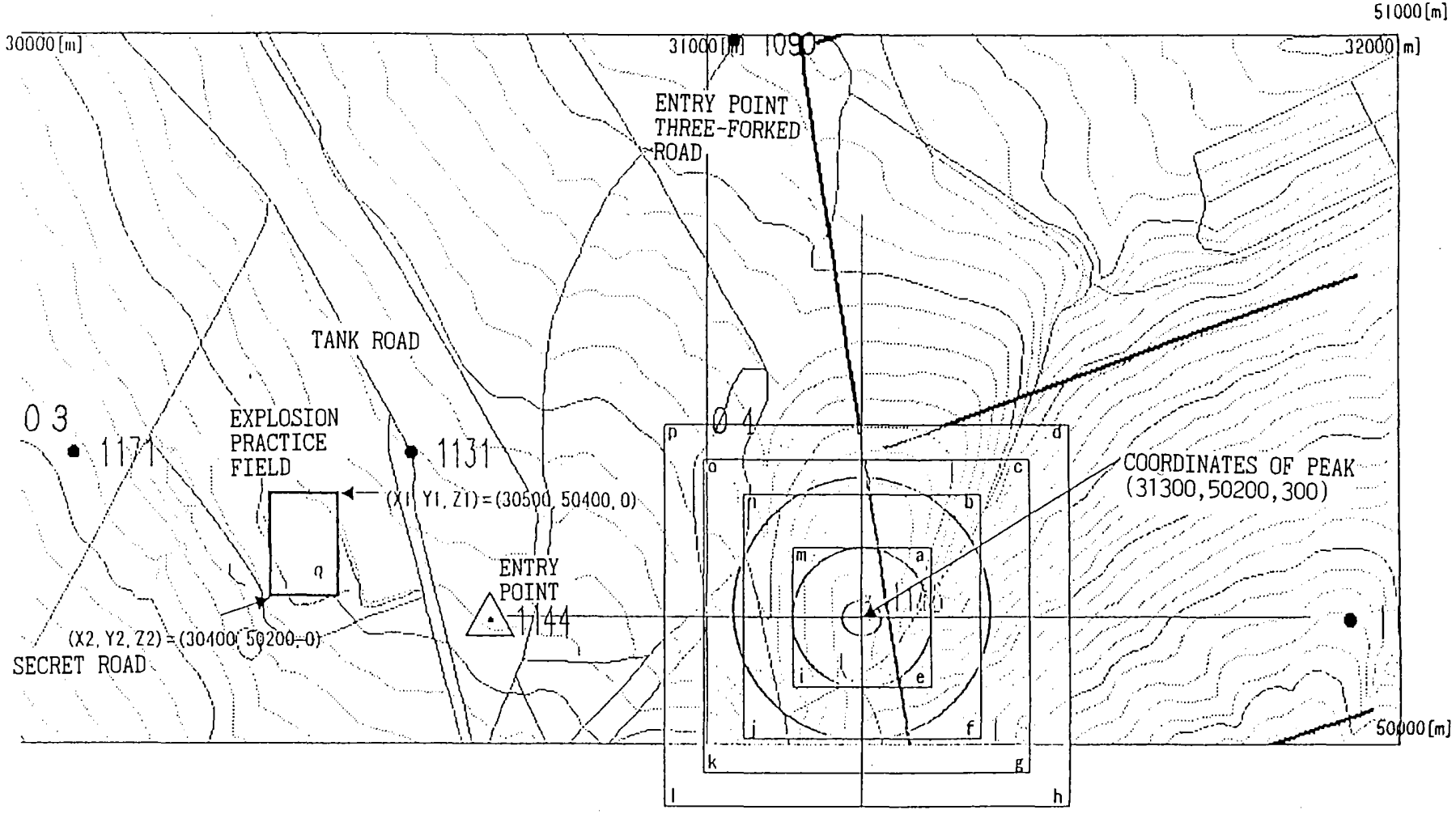

30000[m]
31000[m]
32000[m]
51000[m]
50000[m]
ENTRY POINT
THREE-FORKED
ROAD
TANK ROAD
03
1171
EXPLOSION
PRACTICE
FIELD
1131
(X1, Y1, Z1) = (30500, 50400, 0)
ENTRY
POINT
1144
(X2, Y2, Z2) = (30400, 50200, 0)
SECRET ROAD
04
COORDINATES OF PEAK
(31300, 50200, 300)
p
d
o
c
n
b
m
a
i
e
j
f
k
g
l
h
q

Fig.33

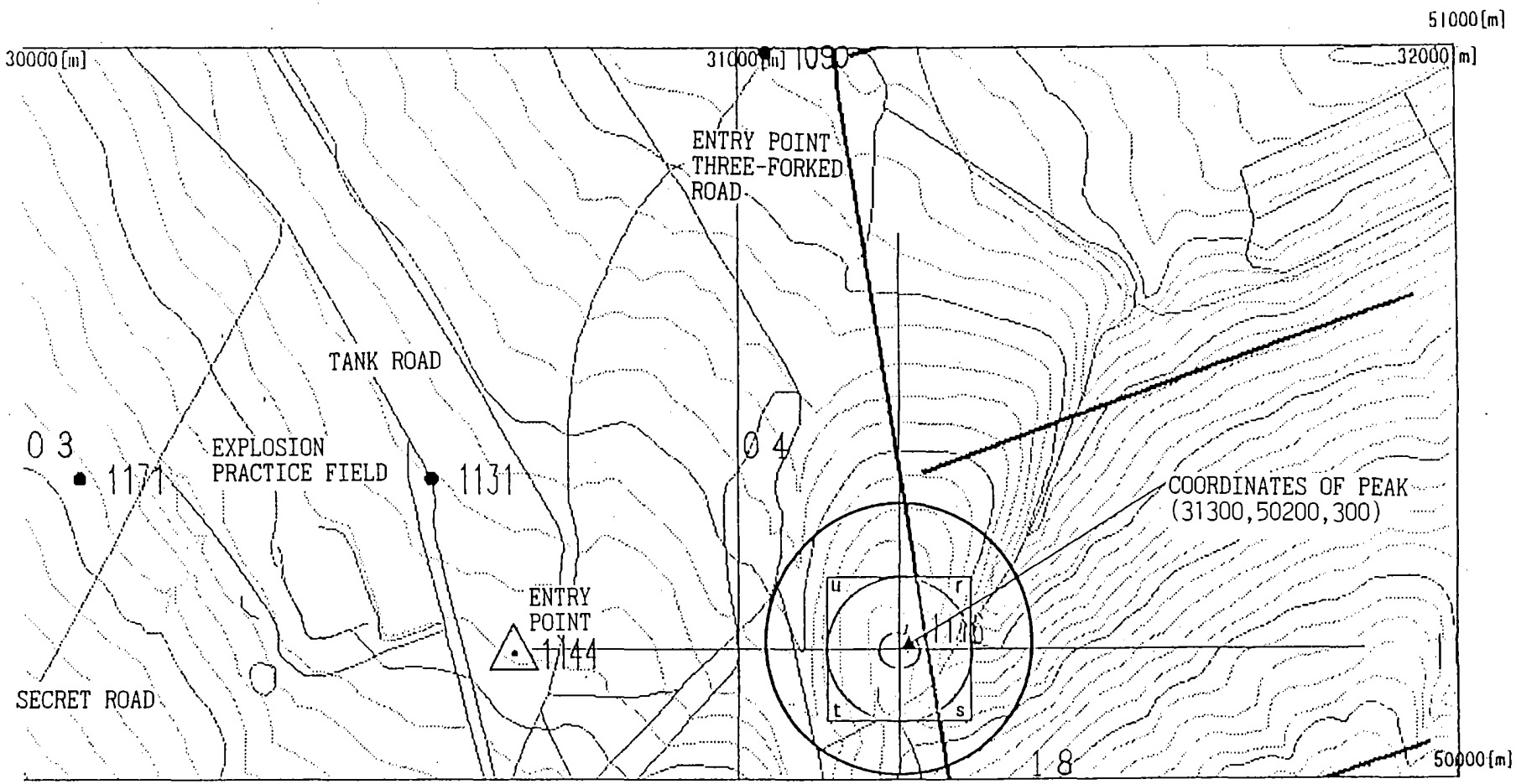

51000[m]
30000[m]
31000[m]
32000[m]
1090
ENTRY POINT
THREE-FORKED
ROAD
TANK ROAD
03
1171
EXPLOSION
PRACTICE FIELD
1131
04
COORDINATES OF PEAK
(31300,50200,300)
ENTRY
POINT
1144
1118
u
r
t
s
SECRET ROAD
18
50000[m]

Fig.34

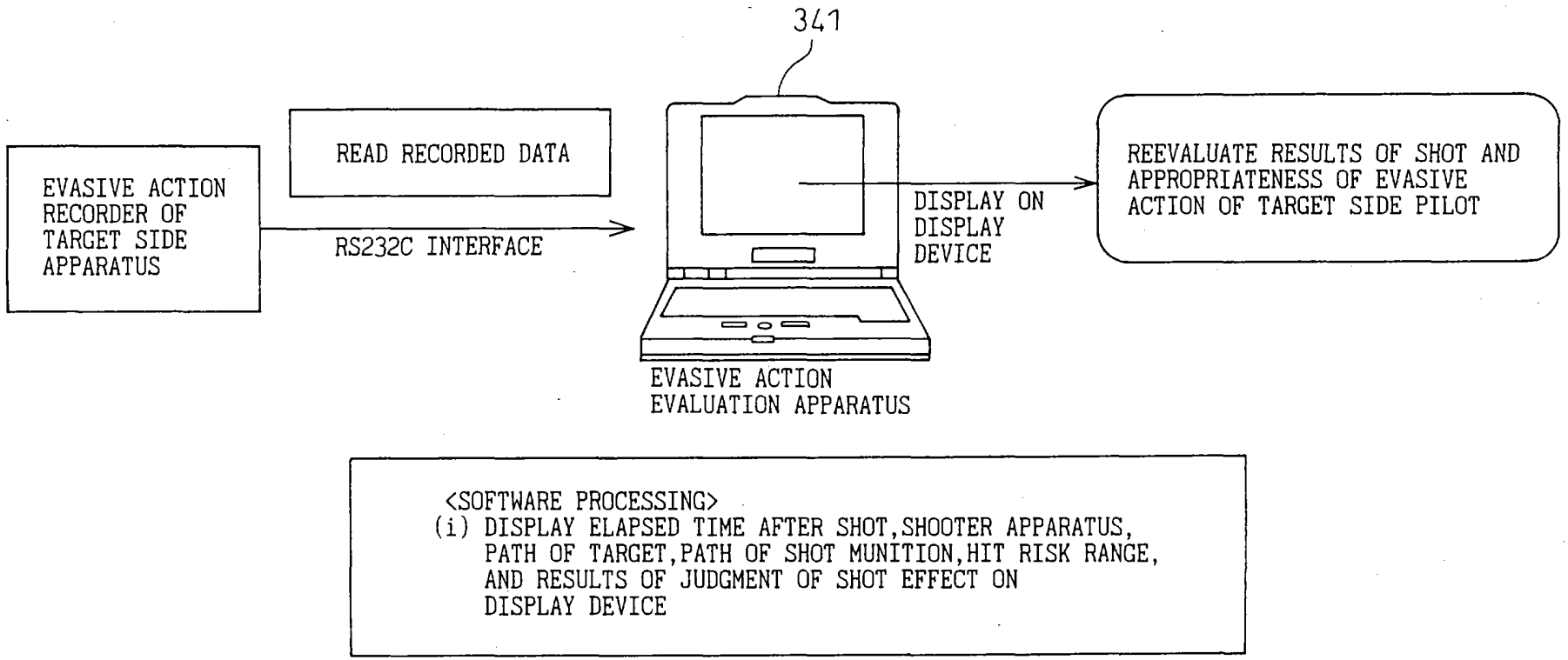

341
EVASIVE ACTION RECORDER OF TARGET SIDE APPARATUS
READ RECORDED DATA
RS232C INTERFACE
DISPLAY ON DISPLAY DEVICE
REEVALUATE RESULTS OF SHOT AND APPROPRIATENESS OF EVASIVE ACTION OF TARGET SIDE PILOT
EVASIVE ACTION EVALUATION APPARATUS
<SOFTWARE PROCESSING>
(i) DISPLAY ELAPSED TIME AFTER SHOT, SHOOTER APPARATUS, PATH OF TARGET, PATH OF SHOT MUNITION, HIT RISK RANGE, AND RESULTS OF JUDGMENT OF SHOT EFFECT ON DISPLAY DEVICE

Fig.35

ELAPSED TIME [s]	TARGET SIDE POSITION	SHOT MUNITION POSITION
0	(Xr1, Yr1, Zr1)	(Xp1, Yp1, Zp1)
t1	(Xr2, Yr2, Zr2)	(Xp2, Yp2, Zp2)
t2	(Xr3, Yr3, Zr3)	(Xp3, Yp3, Zp3)
t3	(Xr4, Yr4, Zr4)	(Xp4, Yp4, Zp4)
t4	(Xr5, Yr5, Zr5)	(Xp1, Yp5, Zp5)
⋮	⋮	⋮
Te	(Xrn, Yrn, Zrn)	(Xpn, Ypn, Zpn)

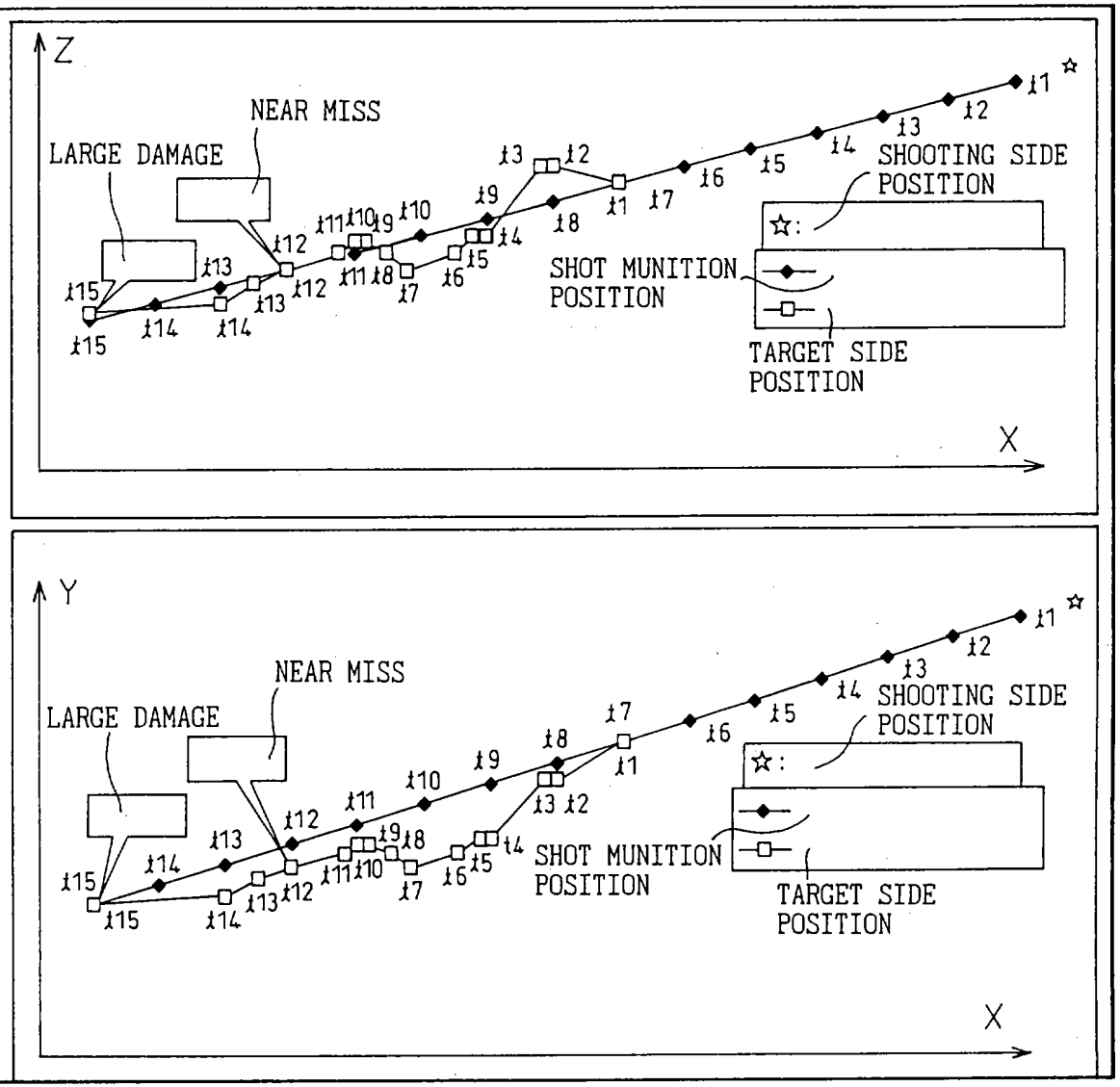


Fig. 36

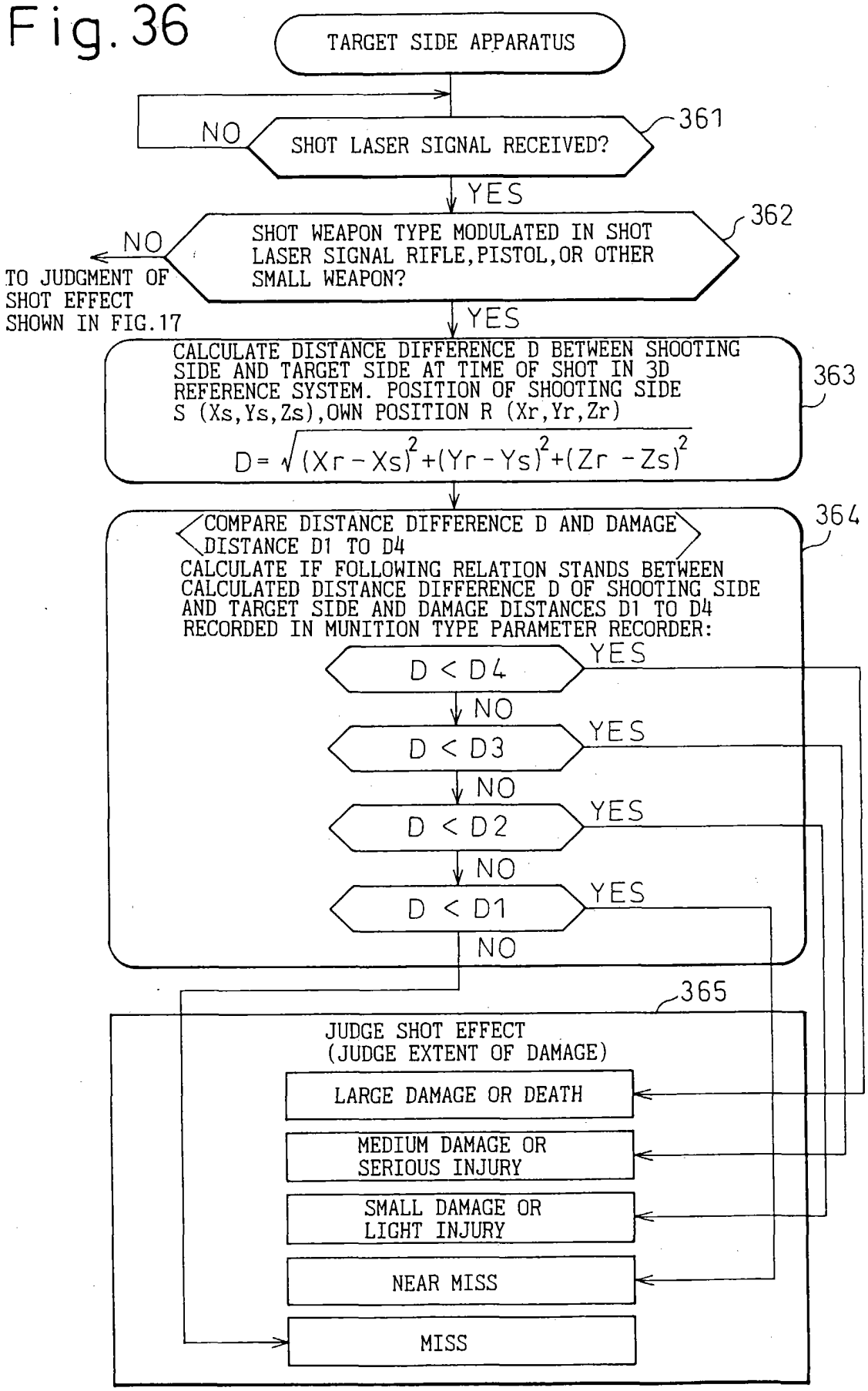

TARGET SIDE APPARATUS
NO
SHOT LASER SIGNAL RECEIVED?
361
YES
SHOT WEAPON TYPE MODULATED IN SHOT LASER SIGNAL RIFLE,PISTOL,OR OTHER SMALL WEAPON?
362
NO
TO JUDGMENT OF SHOT EFFECT SHOWN IN FIG.17
YES
CALCULATE DISTANCE DIFFERENCE D BETWEEN SHOOTING SIDE AND TARGET SIDE AT TIME OF SHOT IN 3D REFERENCE SYSTEM. POSITION OF SHOOTING SIDE S (Xs,Ys,Zs),OWN POSITION R (Xr,Yr,Zr)
$D=\sqrt{(Xr-Xs)^2+(Yr-Ys)^2+(Zr-Zs)^2}$
363
COMPARE DISTANCE DIFFERENCE D AND DAMAGE DISTANCE D1 TO D4
CALCULATE IF FOLLOWING RELATION STANDS BETWEEN CALCULATED DISTANCE DIFFERENCE D OF SHOOTING SIDE AND TARGET SIDE AND DAMAGE DISTANCES D1 TO D4 RECORDED IN MUNITION TYPE PARAMETER RECORDER:
364
D < D4
YES
NO
D < D3
YES
NO
D < D2
YES
NO
D < D1
YES
NO
365
JUDGE SHOT EFFECT (JUDGE EXTENT OF DAMAGE)
LARGE DAMAGE OR DEATH
MEDIUM DAMAGE OR SERIOUS INJURY
SMALL DAMAGE OR LIGHT INJURY
NEAR MISS
MISS

Fig. 37

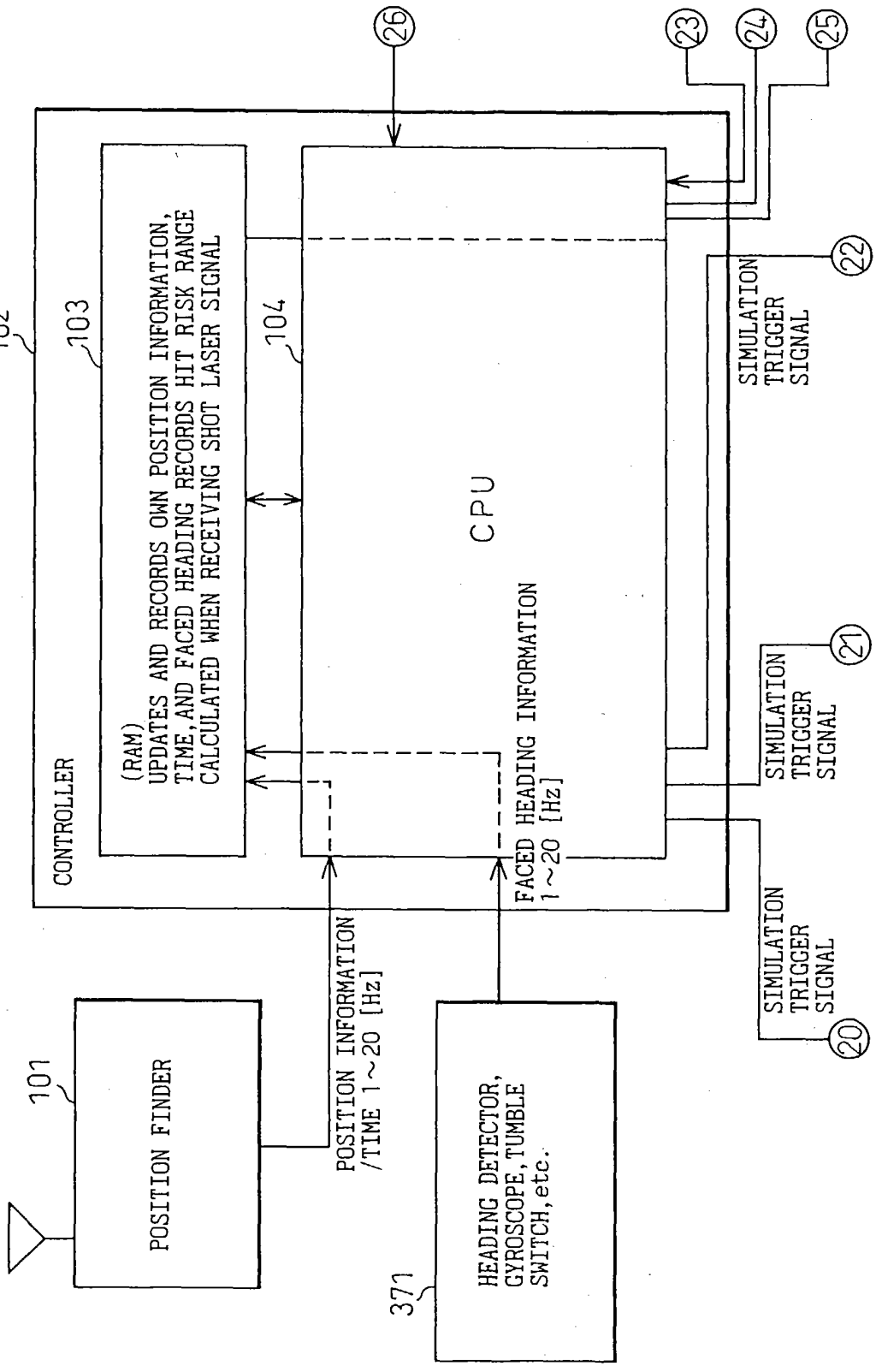

102
CONTROLLER
103
(RAM)
UPDATES AND RECORDS OWN POSITION INFORMATION, TIME, AND FACED HEADING RECORDS HIT RISK RANGE CALCULATED WHEN RECEIVING SHOT LASER SIGNAL
104
CPU
26
23
24
25
22
SIMULATION TRIGGER SIGNAL
21
SIMULATION TRIGGER SIGNAL
20
SIMULATION TRIGGER SIGNAL
FACED HEADING INFORMATION 1~20 [Hz]
POSITION INFORMATION /TIME 1~20 [Hz]
101
POSITION FINDER
371
HEADING DETECTOR, GYROSCOPE, TUMBLE SWITCH, etc.

Fig. 38

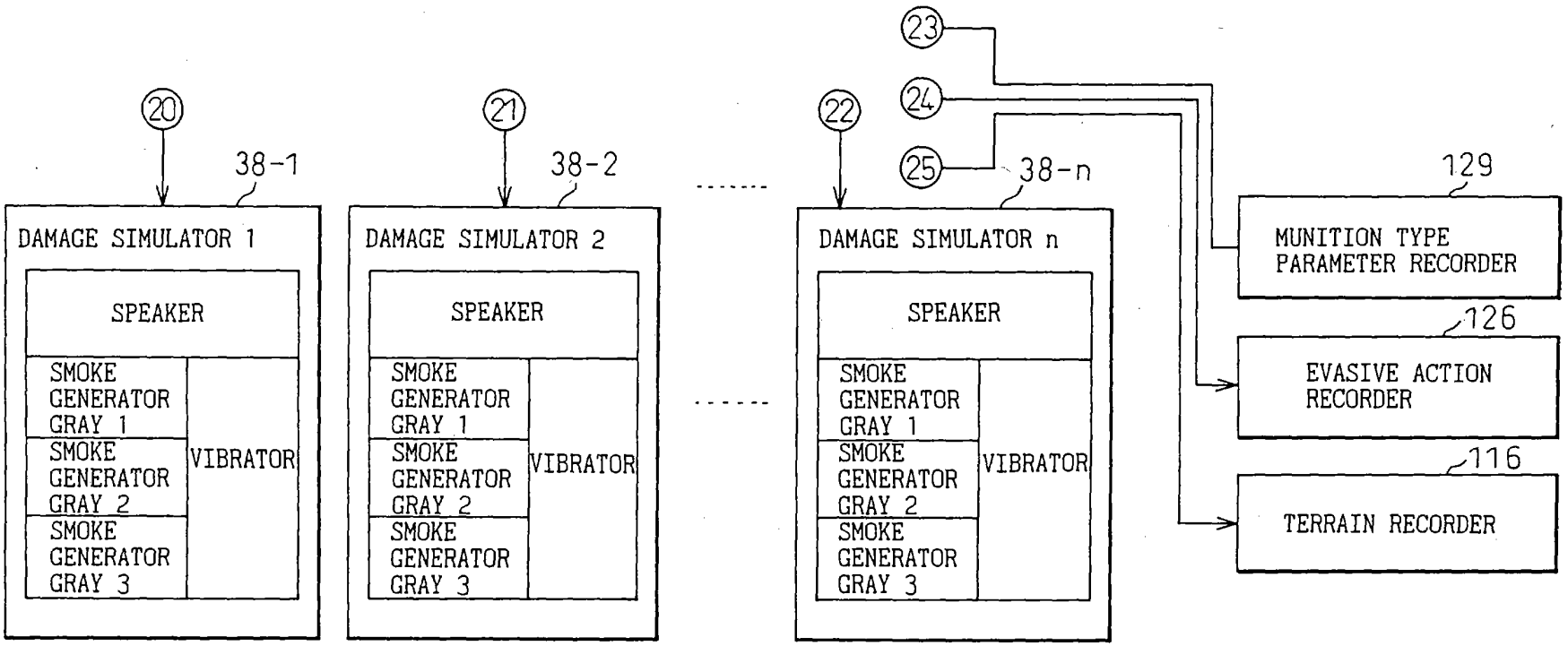

20
21
22
23
24
25
38-1
38-2
38-n
129
DAMAGE SIMULATOR 1
DAMAGE SIMULATOR 2
DAMAGE SIMULATOR n
SPEAKER
SMOKE GENERATOR GRAY 1
SMOKE GENERATOR GRAY 2
SMOKE GENERATOR GRAY 3
VIBRATOR
MUNITION TYPE PARAMETER RECORDER
126
EVASIVE ACTION RECORDER
116
TERRAIN RECORDER

Fig.39

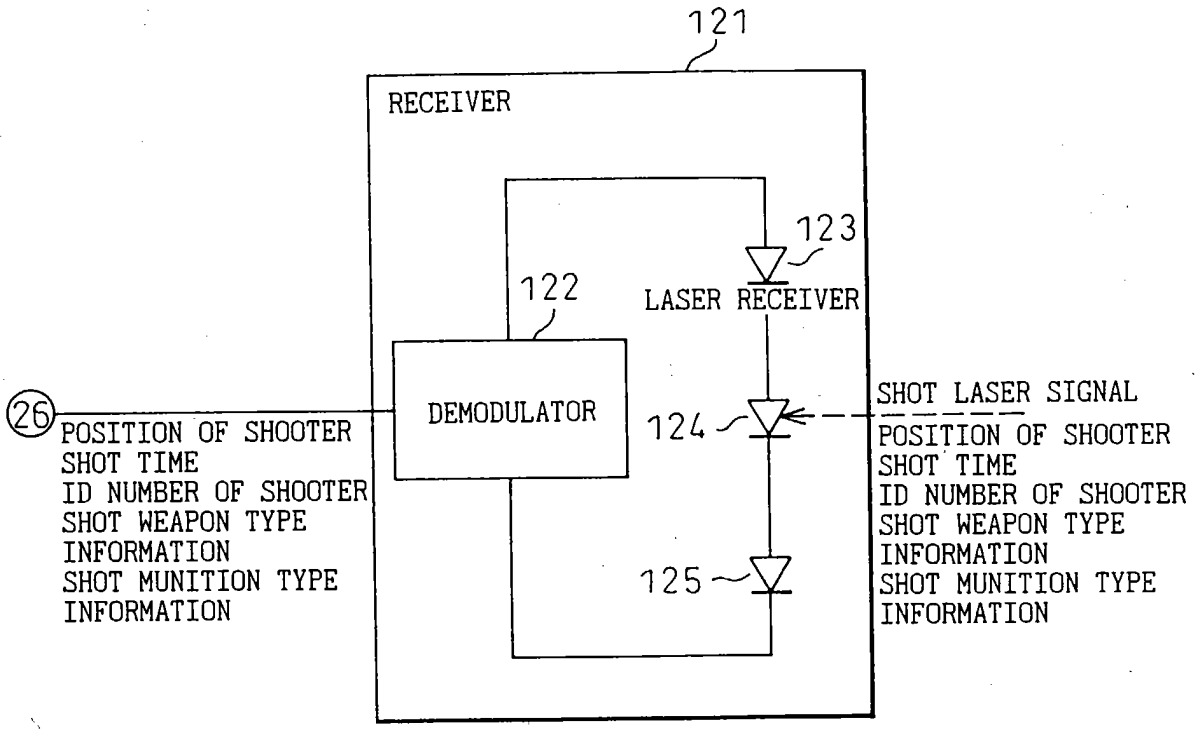
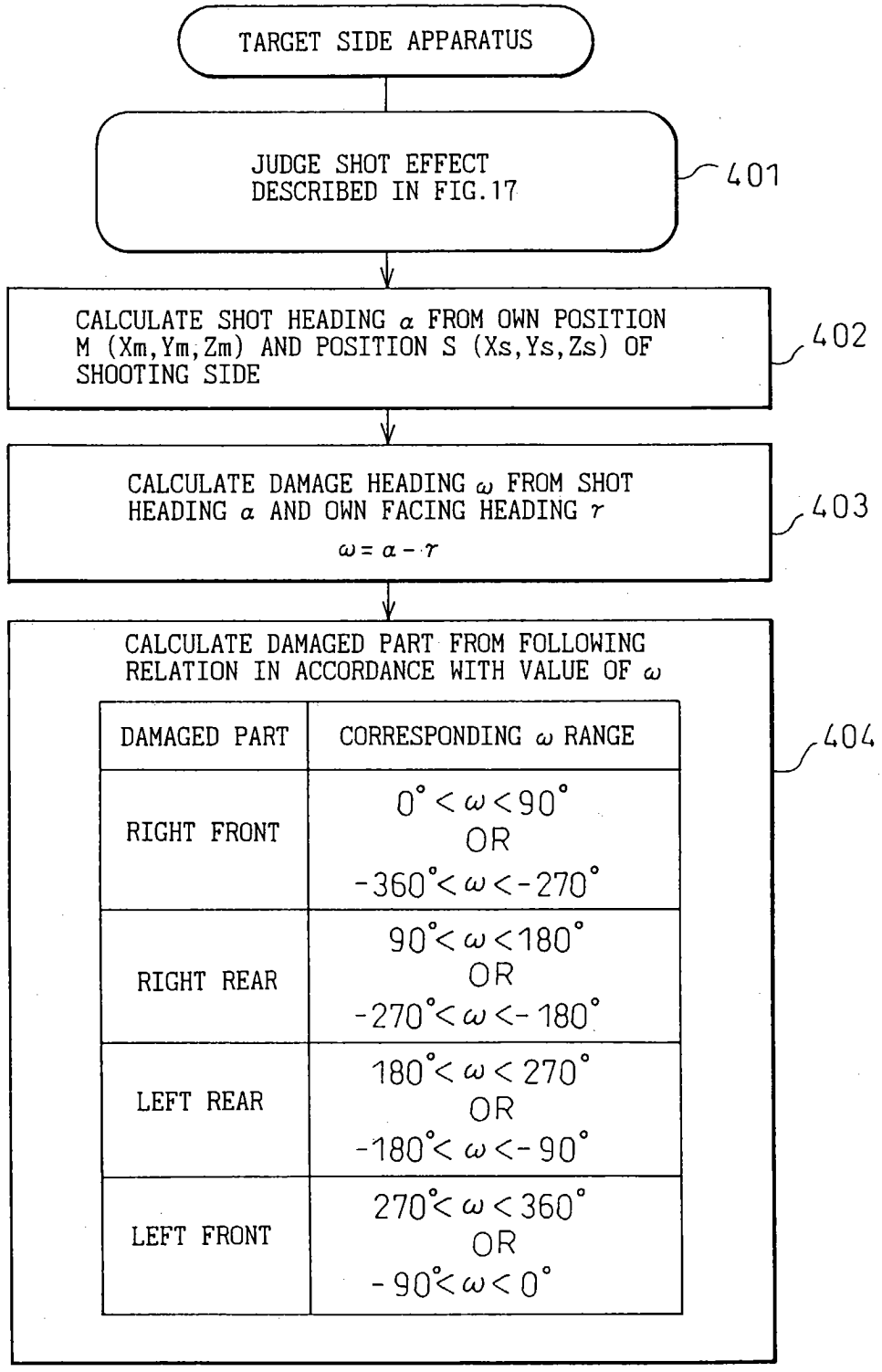

121
RECEIVER
123
122
LASER RECEIVER
DEMODULATOR
124
125
26
POSITION OF SHOOTER
SHOT TIME
ID NUMBER OF SHOOTER
SHOT WEAPON TYPE
INFORMATION
SHOT MUNITION TYPE
INFORMATION
SHOT LASER SIGNAL
POSITION OF SHOOTER
SHOT TIME
ID NUMBER OF SHOOTER
SHOT WEAPON TYPE
INFORMATION
SHOT MUNITION TYPE
INFORMATION

Fig.40



DAMAGED PART	CORRESPONDING ω RANGE
RIGHT FRONT	$0^\circ < \omega < 90^\circ$ OR $-360^\circ < \omega < -270^\circ$
RIGHT REAR	$90^\circ < \omega < 180^\circ$ OR $-270^\circ < \omega < -180^\circ$
LEFT REAR	$180^\circ < \omega < 270^\circ$ OR $-180^\circ < \omega < -90^\circ$
LEFT FRONT	$270^\circ < \omega < 360^\circ$ OR $-90^\circ < \omega < 0^\circ$

Fig.41

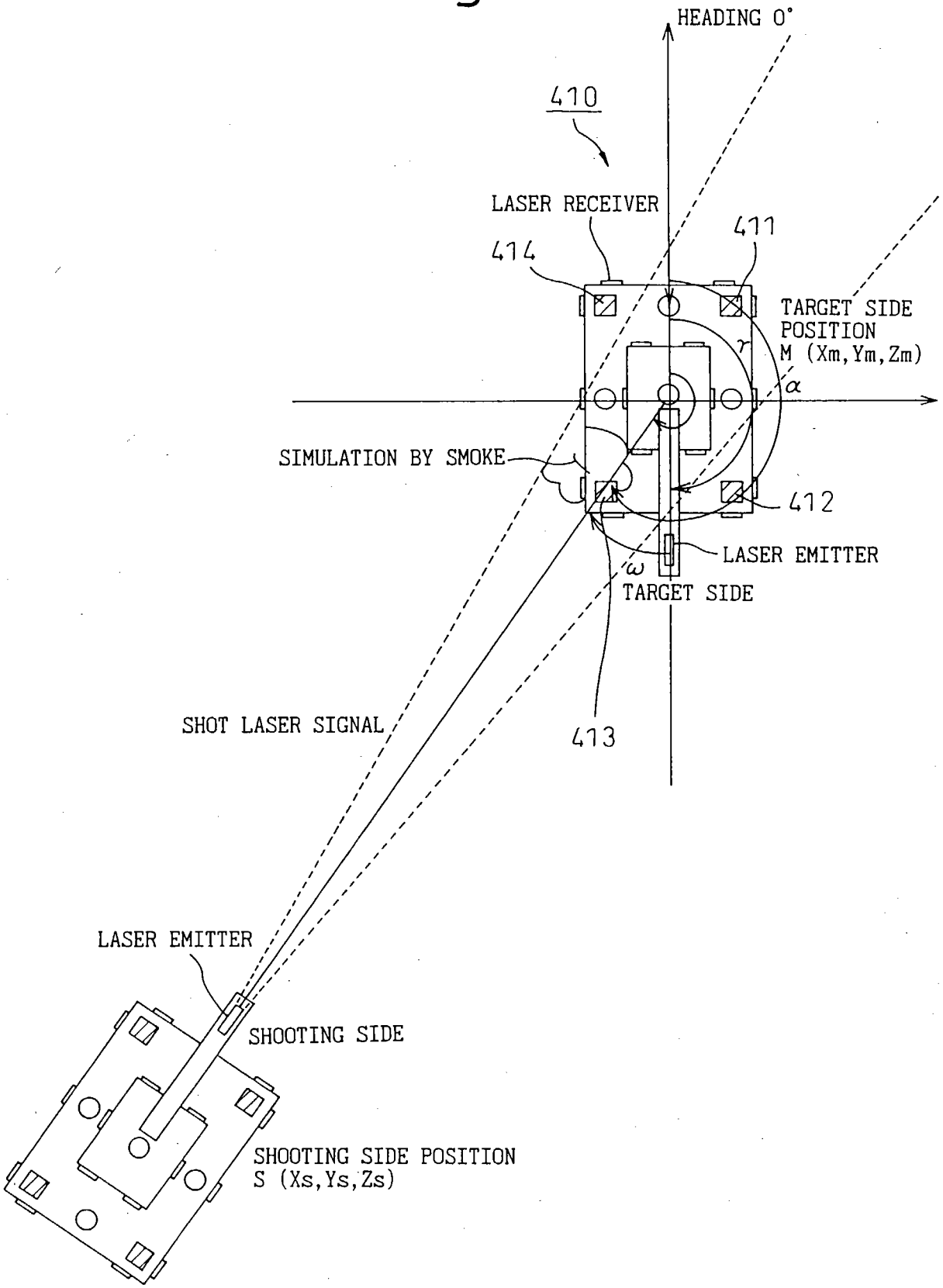

HEADING 0°
410
LASER RECEIVER
414
411
TARGET SIDE
POSITION
M (Xm,Ym,Zm)
γ
α
SIMULATION BY SMOKE
412
LASER EMITTER
ω
TARGET SIDE
SHOT LASER SIGNAL
413
LASER EMITTER
SHOOTING SIDE
SHOOTING SIDE POSITION
S (Xs,Ys,Zs)

Fig. 42

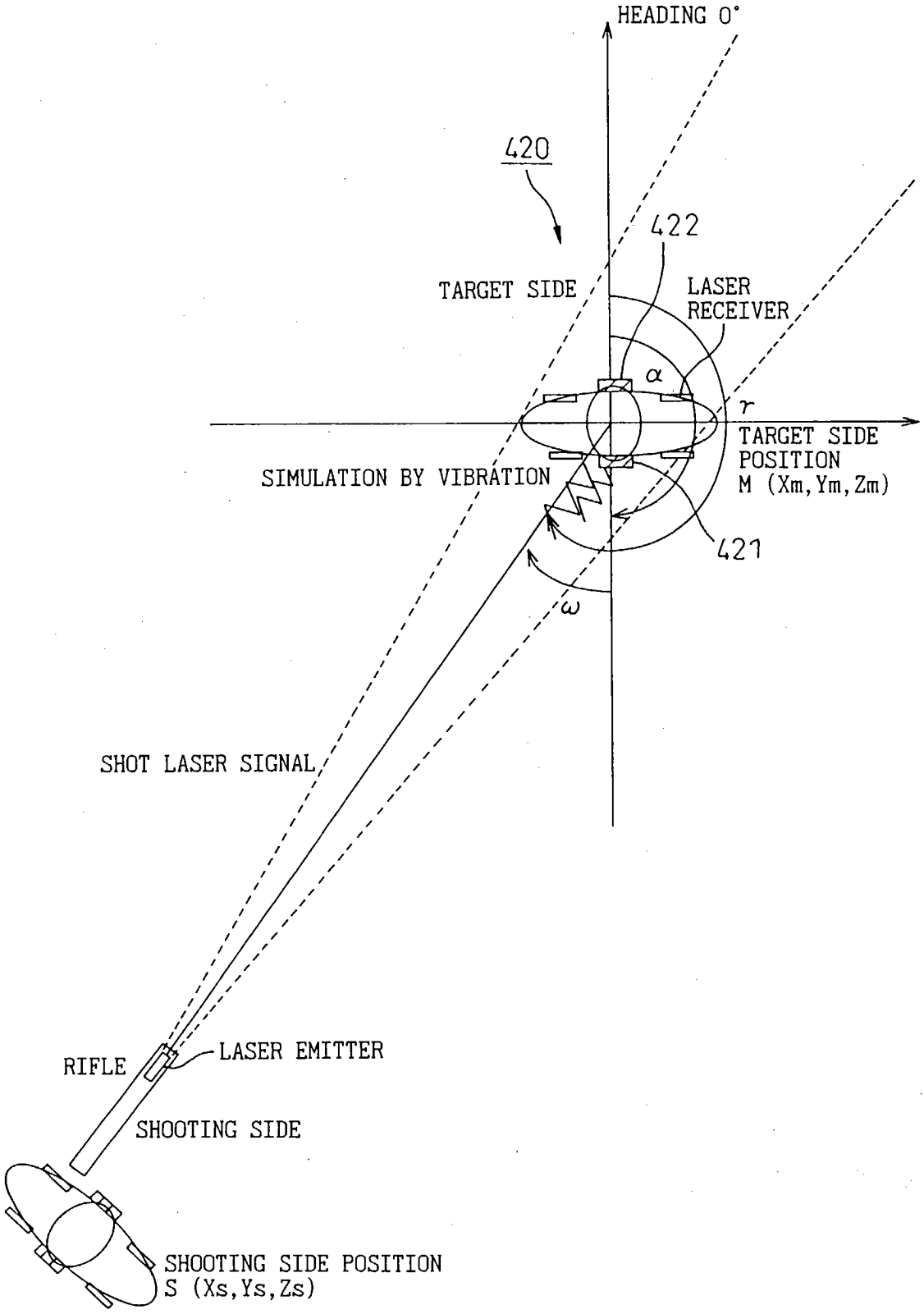

HEADING 0°
420
422
TARGET SIDE
LASER
RECEIVER
α
r
TARGET SIDE
POSITION
M (Xm, Ym, Zm)
SIMULATION BY VIBRATION
421
ω
SHOT LASER SIGNAL
RIFLE
LASER EMITTER
SHOOTING SIDE
SHOOTING SIDE POSITION
S (Xs, Ys, Zs)

Fig.43

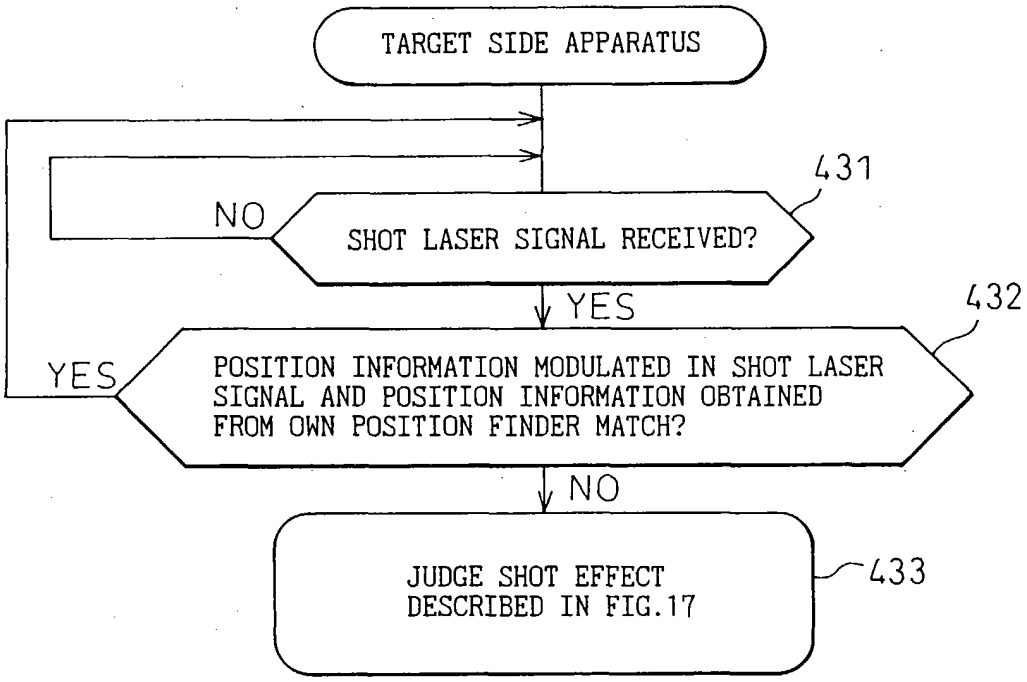

TARGET SIDE APPARATUS
431
NO
SHOT LASER SIGNAL RECEIVED?
YES
432
YES
POSITION INFORMATION MODULATED IN SHOT LASER SIGNAL AND POSITION INFORMATION OBTAINED FROM OWN POSITION FINDER MATCH?
NO
JUDGE SHOT EFFECT DESCRIBED IN FIG.17
433

Fig. 44

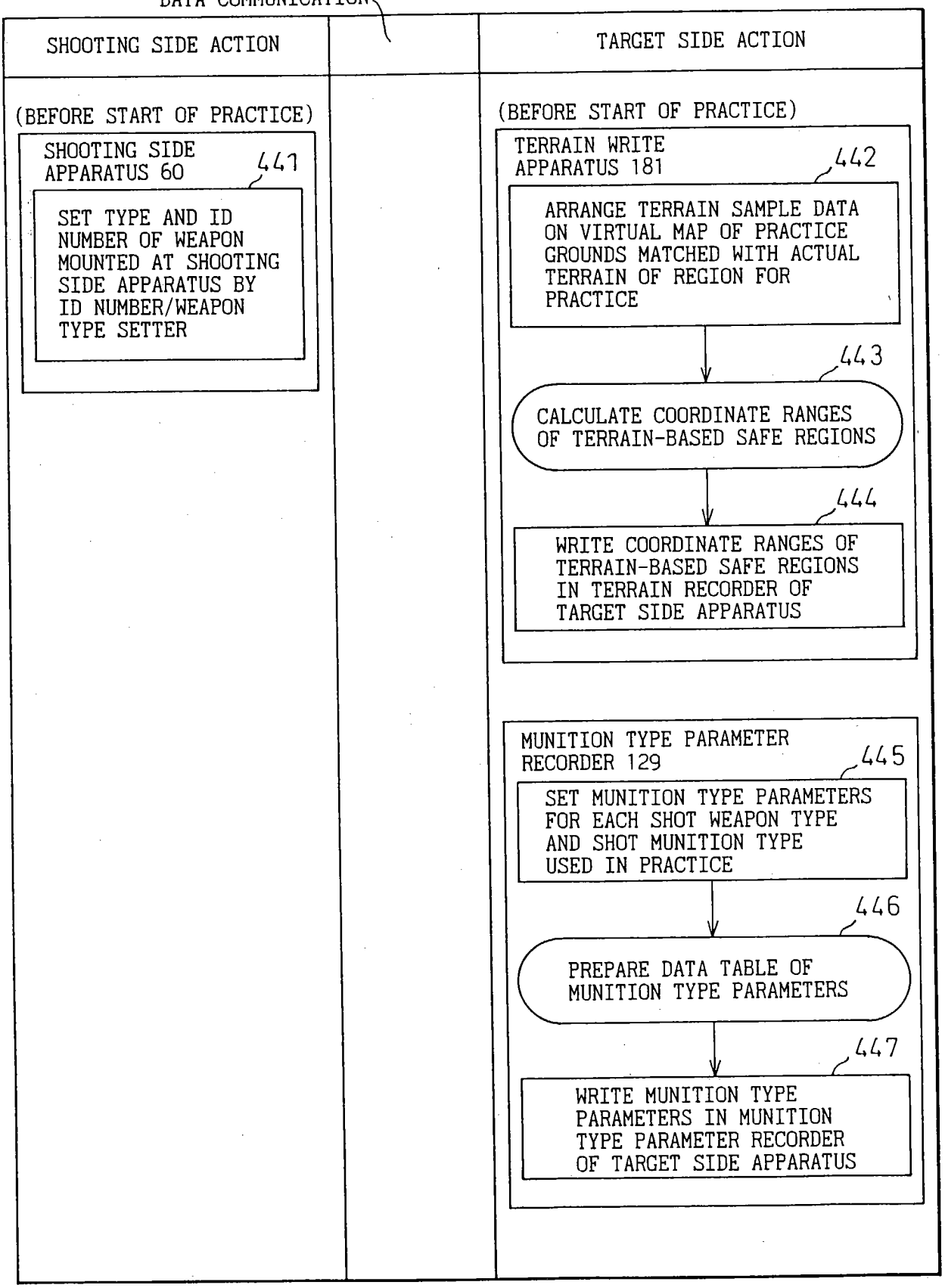

DATA COMMUNICATION
SHOOTING SIDE ACTION
TARGET SIDE ACTION
(BEFORE START OF PRACTICE)
SHOOTING SIDE APPARATUS 60
441
SET TYPE AND ID NUMBER OF WEAPON MOUNTED AT SHOOTING SIDE APPARATUS BY ID NUMBER/WEAPON TYPE SETTER
(BEFORE START OF PRACTICE)
TERRAIN WRITE APPARATUS 181
442
ARRANGE TERRAIN SAMPLE DATA ON VIRTUAL MAP OF PRACTICE GROUNDS MATCHED WITH ACTUAL TERRAIN OF REGION FOR PRACTICE
443
CALCULATE COORDINATE RANGES OF TERRAIN-BASED SAFE REGIONS
444
WRITE COORDINATE RANGES OF TERRAIN-BASED SAFE REGIONS IN TERRAIN RECORDER OF TARGET SIDE APPARATUS
MUNITION TYPE PARAMETER RECORDER 129
445
SET MUNITION TYPE PARAMETERS FOR EACH SHOT WEAPON TYPE AND SHOT MUNITION TYPE USED IN PRACTICE
446
PREPARE DATA TABLE OF MUNITION TYPE PARAMETERS
447
WRITE MUNITION TYPE PARAMETERS IN MUNITION TYPE PARAMETER RECORDER OF TARGET SIDE APPARATUS

Fig.45

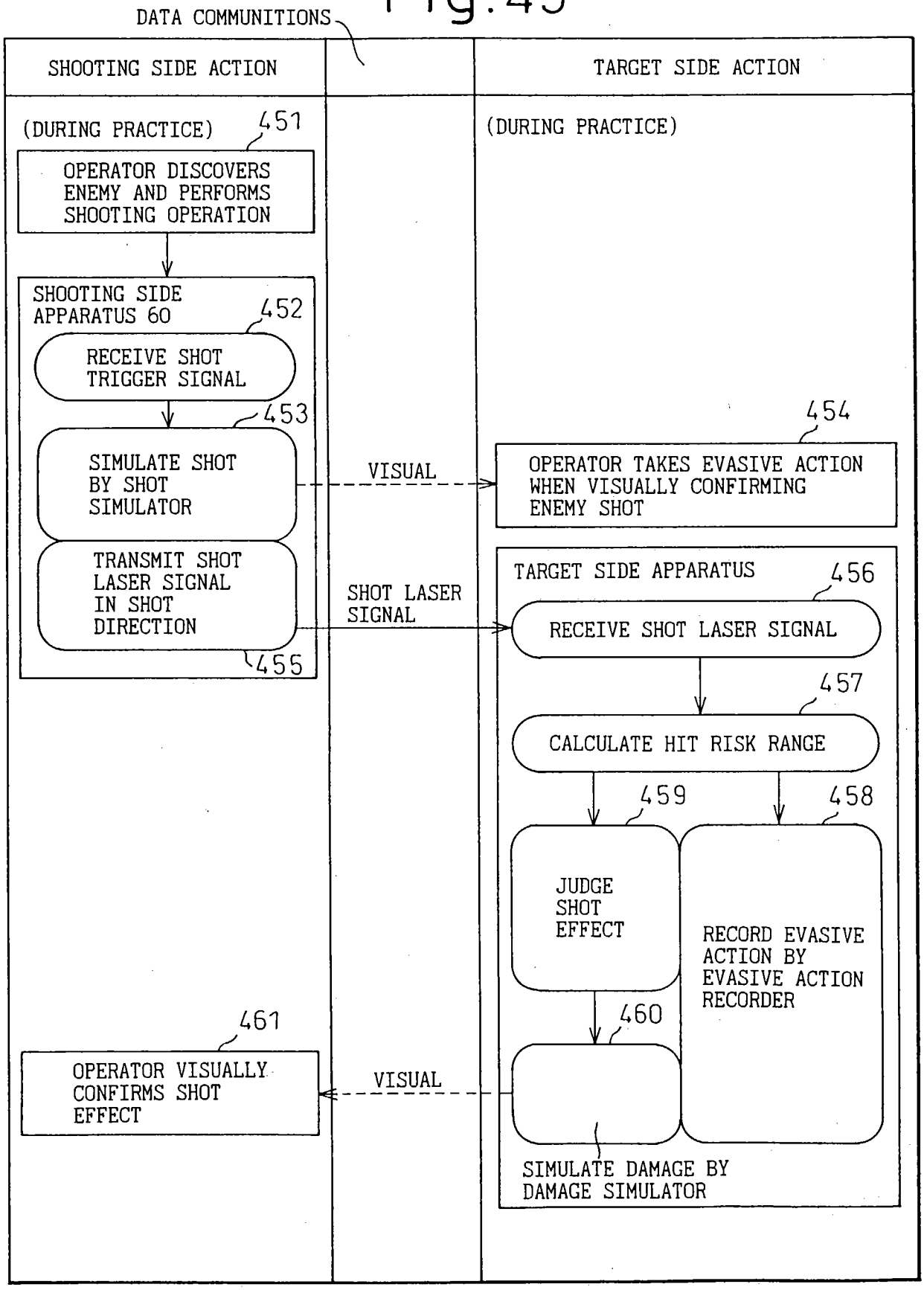

DATA COMMUNITIONS
SHOOTING SIDE ACTION
TARGET SIDE ACTION
(DURING PRACTICE)
451
OPERATOR DISCOVERS ENEMY AND PERFORMS SHOOTING OPERATION
SHOOTING SIDE APPARATUS 60
452
RECEIVE SHOT TRIGGER SIGNAL
453
SIMULATE SHOT BY SHOT SIMULATOR
TRANSMIT SHOT LASER SIGNAL IN SHOT DIRECTION
455
VISUAL
SHOT LASER SIGNAL
(DURING PRACTICE)
454
OPERATOR TAKES EVASIVE ACTION WHEN VISUALLY CONFIRMING ENEMY SHOT
TARGET SIDE APPARATUS
456
RECEIVE SHOT LASER SIGNAL
457
CALCULATE HIT RISK RANGE
459
458
JUDGE SHOT EFFECT
RECORD EVASIVE ACTION BY EVASIVE ACTION RECORDER
460
SIMULATE DAMAGE BY DAMAGE SIMULATOR
461
OPERATOR VISUALLY CONFIRMS SHOT EFFECT
VISUAL

Fig.46

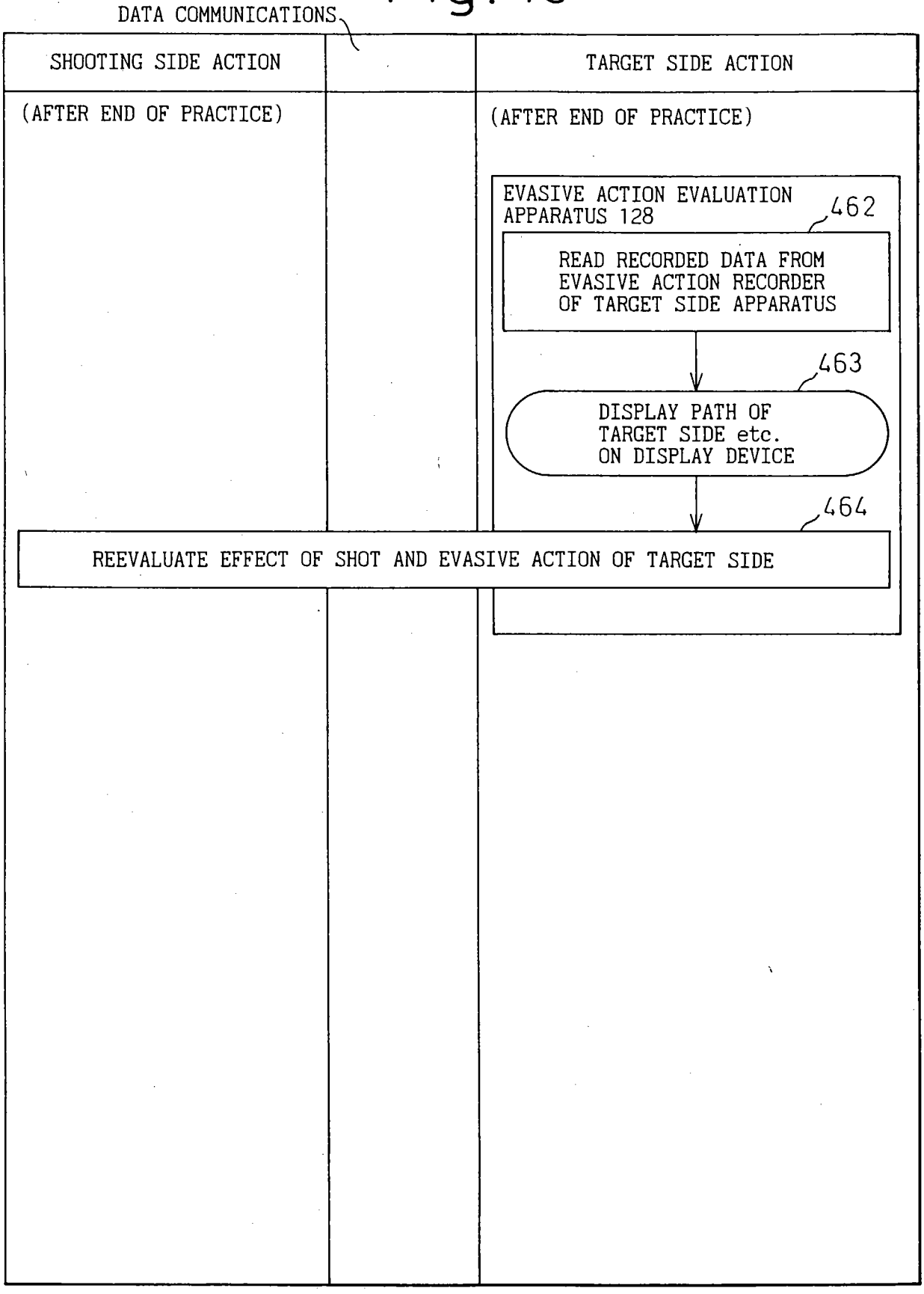
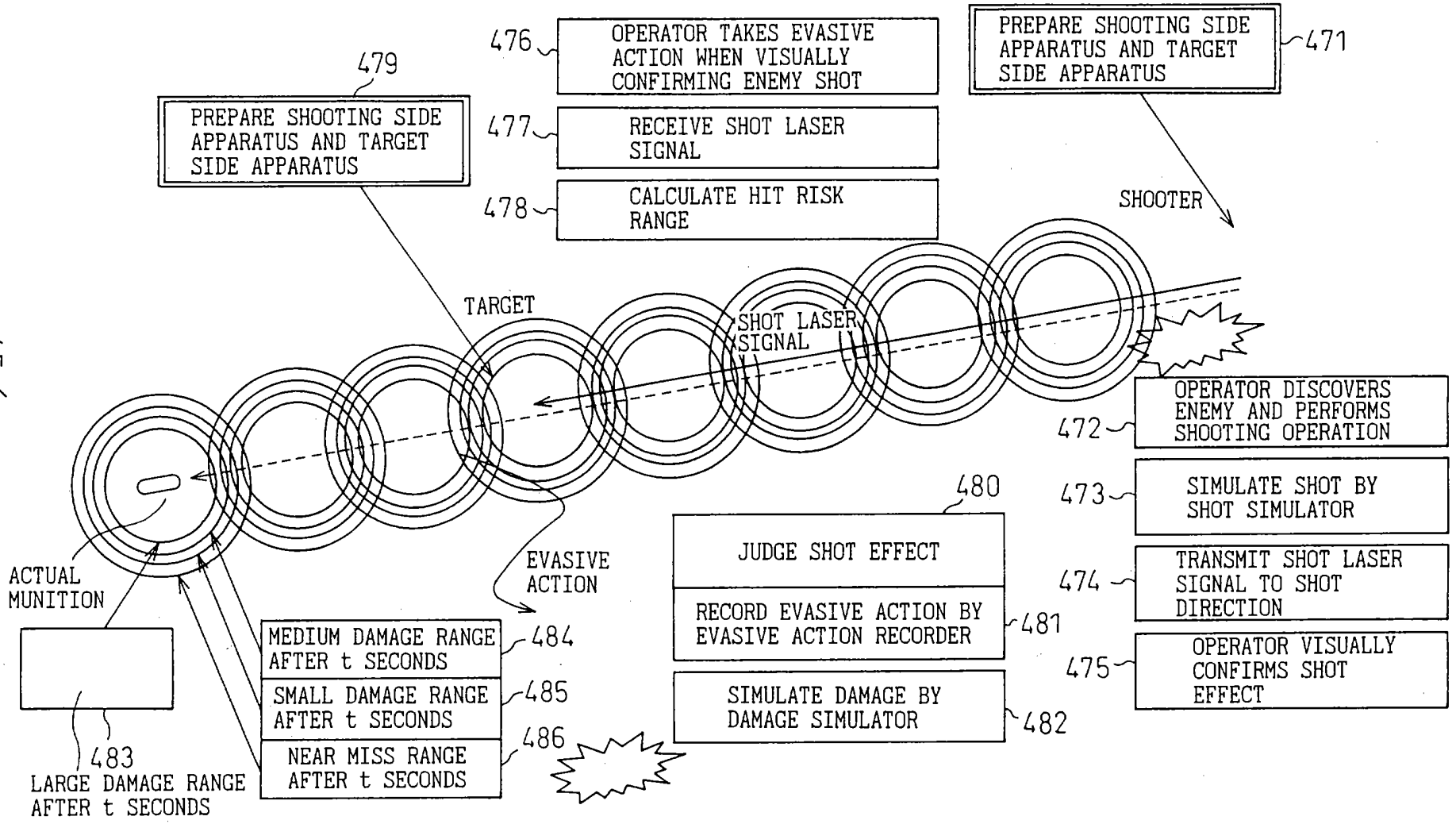

DATA COMMUNICATIONS
SHOOTING SIDE ACTION
TARGET SIDE ACTION
(AFTER END OF PRACTICE)
(AFTER END OF PRACTICE)
EVASIVE ACTION EVALUATION APPARATUS 128
462
READ RECORDED DATA FROM EVASIVE ACTION RECORDER OF TARGET SIDE APPARATUS
463
DISPLAY PATH OF TARGET SIDE etc. ON DISPLAY DEVICE
464
REEVALUATE EFFECT OF SHOT AND EVASIVE ACTION OF TARGET SIDE

Fig. 47


PREPARE SHOOTING SIDE APPARATUS AND TARGET SIDE APPARATUS
471
OPERATOR TAKES EVASIVE ACTION WHEN VISUALLY CONFIRMING ENEMY SHOT
476
RECEIVE SHOT LASER SIGNAL
477
CALCULATE HIT RISK RANGE
478
479
PREPARE SHOOTING SIDE APPARATUS AND TARGET SIDE APPARATUS
SHOOTER
TARGET
SHOT LASER SIGNAL
OPERATOR DISCOVERS ENEMY AND PERFORMS SHOOTING OPERATION
472
SIMULATE SHOT BY SHOT SIMULATOR
473
TRANSMIT SHOT LASER SIGNAL TO SHOT DIRECTION
474
OPERATOR VISUALLY CONFIRMS SHOT EFFECT
475
480
JUDGE SHOT EFFECT
RECORD EVASIVE ACTION BY EVASIVE ACTION RECORDER
481
SIMULATE DAMAGE BY DAMAGE SIMULATOR
482
EVASIVE ACTION
ACTUAL MUNITION
MEDIUM DAMAGE RANGE AFTER t SECONDS
484
SMALL DAMAGE RANGE AFTER t SECONDS
485
NEAR MISS RANGE AFTER t SECONDS
486
483
LARGE DAMAGE RANGE AFTER t SECONDS